MARCH 8, 1954

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

Today's Problem:-

Why network voltages for large new office buildings should be increased beyond 120/208 volts

For Reasons:-

See page 80

IN 3 EASY STEPS

with the Murray Crows'nest

REGISTERED TRADE MARK

1

JUST A SLIGHT PRESSURE

Pull out the handle, press down. That's all that's needed to release ladder from riding position and raise it to the desired inclination. Husky spring action does most of the work. Release handle to lock the ladder.

2

ROTATE

Release locking arrangement. Rotate full 360° easily—there is a handle on each side for convenience. Murray's exclusive semi-automatic mechanism thruout insures complete safety.

3

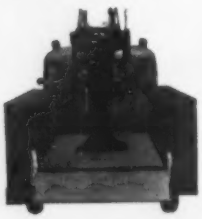
EXTEND

Because of large drum, only a few turns on the windlass are necessary to extend upper section of ladder. The 24" long flat floor of the platform is adjustable to suit any of the inclinations—30° to 72°

LEAVES PLENTY OF FLOOR SPACE

Even on low priced pick-up trucks, the Murray Crows'nest leaves the absolute maximum in standing and loading space. Rotation at 37½" is above usual height of cabinets.

In the riding position, the Murray Crows'nest snuggles close to the top of the cab. Low center of gravity keeps the truck in good balance.



Your men can do more jobs per day because operation of the Murray Crows'nest is quicker, easier and less fatiguing. Each of the steps — inclination, rotation and extension — is easy-flowing and effortless. The reason is simple — Murray engineers have designed the Crows'nest to do most of the work itself. Every part is in perfect balance so that only a slight pressure is needed to start each action.

MURRAY MANUFACTURING CORPORATION
1250 Atlantic Avenue, Brooklyn 16, N. Y.

Send specifications, drawings, mounting instructions and quote on:

29'..... 32'9..... 36'8.....
Pedestal Style Crows'nest

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

.....

Murray®

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1250 Atlantic Avenue, Brooklyn 16, New York

Service Entrance and Meter Equipment • Magnetic Hydraulic Circuit Breakers
Safety Switches (Types A, C & D). • Current Limiting Reactors • Utility Specialties

Meet This Week's Writers

J. C. Smith, the man who wrote the aerial cable article on page 86, is general division engineer in the distribution engineering department of Commonwealth Edison Co.

J. C. SMITH

After receiving an electrical engineering degree from Ohio State University in 1926, Smith joined Public Service Co of Northern Illinois. Upon completion of a year's engineering training course, he was assigned to distribution engineering. When PS was consolidated with Commonwealth last year, Smith was transferred to his present position.

T. H. LEE A. P. FUGILL

Just how digital computers aid engineers is explained on page 89 by the Detroit Edison team of Lee and Fugill.

Since joining Detroit Edison in 1951, T. H. Lee has worked on system planning and analytical problems involving use of a-c network analyzer and digital computers. Lee received a B.S. degree in electrical engineering from Case Institute of Technology in 1950, and an M.E.E. degree from Cornell University in 1951. His hobbies are mathematics and music.

A. P. Fugill, who earned an electrical engineering degree from Syracuse University, went in 1928 to Detroit Edison. He recently was made chief electrical engineer in the planning and project engineering department.

He has one son, also an electrical engineer, and a grandson. When not active in AIEE activities, he tries his hand at gardening.

Electrical World

Published for 80 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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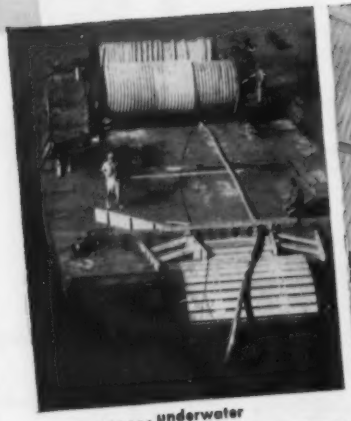
case history

use it anywhere

The versatility of Okolite rubber-insulated high voltage cables is demonstrated by these three typical installations. The first shows an installation of the Portland General Electric Company—two 1,800-ft. 13-kv rubber-insulated submarine cables being laid across the Willamette River. The next shows six 23-kv Okolite-Okoprene transformer leads at The Diamond Portland Cement Company. The bottom, four 390-ft. spans of three-conductor self-supporting Okolite-Okoprene cables at the Covington, Virginia plant of West Virginia Pulp and Paper Company.



. . . . . underwater

. . . . . in racks or conduit

. . . . . on messenger

WHY THEY'RE SWITCHING TO OKOLITE rubber-insulated cables for use up to 35,000 volts

There is a distinct trend among industrials and public utilities toward Okolite rubber-insulated cables for high voltage use.

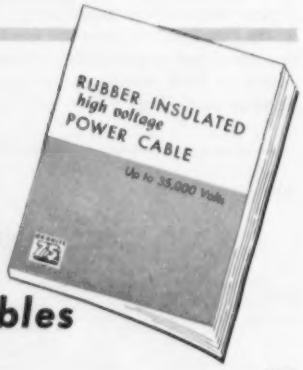
ADVANTAGES

1. Lighter and easier handling.
2. Eliminates sheath corrosion and fatigue.
3. Simplifies splicing and terminating.
4. Moisture does not affect the insulation.
5. No oil migration at high temperatures or elevations.
6. Flexibility simplifies installation.

APPLICATIONS

1. Transmission and distribution circuits.
2. Generator and transformer leads.
3. Vertical risers and shaft cables.
4. Submarine power cables.
5. Portable substation cables and test leads.
6. X-ray cables.

In the air, underground, underwater, in racks, ducts or conduits, Okolite-Okoprene rubber-insulated high voltage cables can be installed easily and permanently. The design and construction of this type of cable has been proved in all kinds of service for more than 25 years. The entire subject of rubber-insulated cable for high voltage application is covered in the new Okonite 128-page manual illustrated at right. Write for Bulletin EW-1075 on your letterhead to The Okonite Company, Passaic, New Jersey.



OKONITE SINCE 1878 *insulated cables*

1872

Equipment for Line Construction and Maintenance

via GraybaR

You can order all your heavy-duty equipment for pole line maintenance and construction from a single convenient source — makes and models known for their quality and reliability.

For example, if it's truck bodies you need, Graybar offers you all-steel units in various styles for construction, maintenance, and general service duties.

Winches and derricks? . . . We can match the right types of equipment to your needs — including models that will handle poles up to 70 feet in length.

For hauling cargo or poles, you can depend on Graybar for trailers and pole dinkeys that fit your needs exactly — whether your operations involve light- or heavy-duty service.

Perhaps right-of-way maintenance is your present concern. Let Graybar furnish your brush killer and spraying equipment. We can also recommend and supply the proper formulas for both dormant and growing season use.

Graybar provides a convenient, efficient source for procurement of all of your other pole-line needs, as well—poles, hardware, wire, strand.

A single responsibility for everything you need . . . when you need it. *Graybar Electric Company, Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.* 408-93

Call Graybar first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

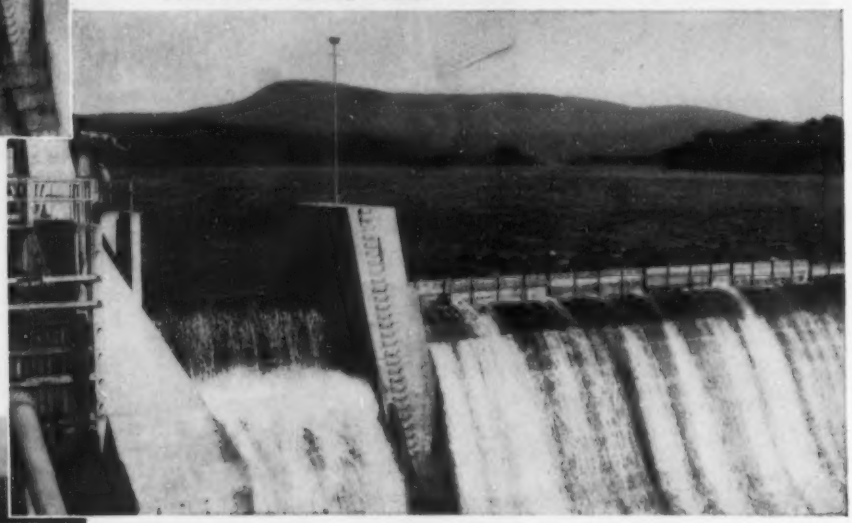
IN OVER 110 PRINCIPAL CITIES

Bascule Crest Gates
by SMITH

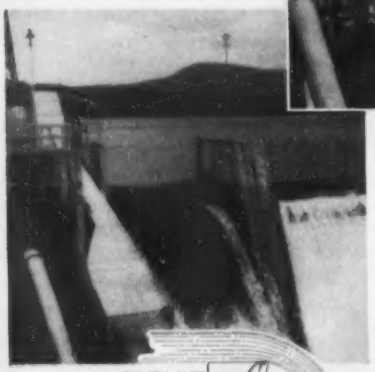
Left: This 8'-6" by 25'-0" SMITH-BASCULE GATE at the Holyoke Water Power Company on the Connecticut River is used principally for sluicing ice and debris away from the intake supplying a 22,000 HP SMITH-KAPLAN turbine. It also helps to prevent the loss of flashboards at times of moderate increases in river flow.

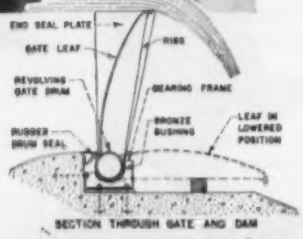
Above:
Gate in closed position.

Below: Gate nearly closed.



Below:
Gate in full open position.





SECTION THROUGH GATE AND DAM

SMITH-BASCULE GATES are hydraulically or electrically operated, with automatic or manual controls.

Available in sizes up to 10 feet in height by 100 feet in length, these gates permit the use of long, unobstructed spillways with controlled flow.

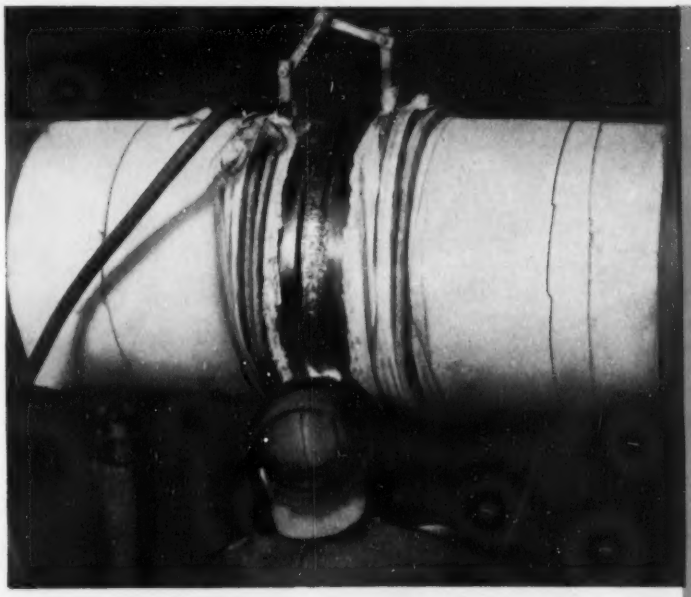
They are used for flood control, increased reservoir storage, and for sluicing.

Write for Bulletin No. 153.

POWER by SMITH — 16,000,000 HP

76 YEARS EXPERIENCE DESIGNING AND MANUFACTURING HYDRAULIC TURBINES AND ACCESSORY POWER PLANT AND PUMPING STATION EQUIPMENT

S. MORGAN SMITH CO. York, Penna., U.S.A.



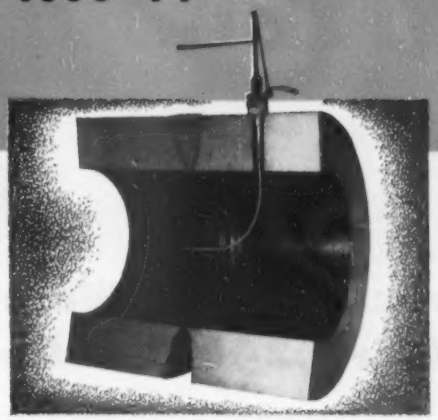
SHOP WELDING 4" WALL PIPE

for steam at 2050 PSI and 1050° F!

You can be confident of the piping fabricated in Grinnell shops, because Grinnell Research predetermines materials and methods, then checks results to insure that specifications are met exactly.

An example of the thoroughness of Grinnell Research is the preparatory work which was done to insure the performance of the piping shown above. This sub-assembly is being fabricated from 4" wall pipe forged from 2¼% chrome, 1% moly steel. To withstand the high pressure and temperature of this installation, Grinnell Research specified the fabricating and welding procedures to be used. This included the time and temperature cycles for preheating and stress relieving, and the correct type of electrodes.

Preliminary test welds on sample pipe were made. These were then cut apart and analyzed to check microstructure and strength of the weld, which had to have the same properties as the pipe itself.



A test piece of 4" wall pipe cut apart to show the quality of the weld. Also illustrated is the method used to introduce a radium capsule into the center of a completed assembly for radiographic examination of the weld.

Taking photomicrograph of specimen of a test weld.

During fabrication, the first inch of each weld was ground smooth and given a complete radiographic examination for possible flaws. Finally the completed weld was checked by radiographic examination.

It's intricate business . . . developing correct fabrication methods for new materials and services. It's one of the jobs for which Grinnell fabrication specialists are well qualified, because Grinnell has the equipment and modern methods, the interpretive engineering, the metallurgical research facilities and the skilled personnel to handle any prefabrication requirement.

GRINNELL

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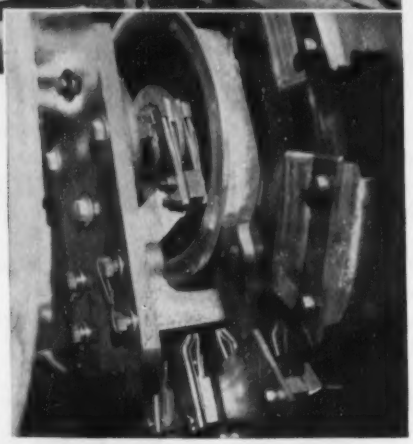
Grinnell Company, Inc., Providence, Rhode Island • **Coast-to-Coast Network of Branch Warehouses and Distributors**

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Allis-Chalmers Gives You

17 YEARS' PROOF

ALLIS-CHALMERS
5/8% STEP VOLTAGE REGULATORS

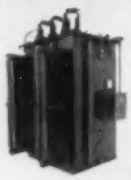


Practically No Wear After 1,240,000 Operations

Pictures above and at right show mechanism and contacts of an Allis-Chalmers power regulator that operated on a west coast utility for 17 years. You can see from these unretouched photos that nearly a million and a quarter operations resulted in practically no wear. This regulator is still in condition to provide many more years of satisfactory service.

You get operating records like this only from Allis-Chalmers. Twenty years of experience designing and building 5/8% step voltage regulators results in rugged construction and proved reliability. Laboratory tests, for example, show that the *Quick-Break* mechanism can withstand five million operations. The 17-year result shown above adds field proof to these laboratory tests.

Next time you consider regulation, for new or replacement installations, it will pay you to check the advantages of Allis-Chalmers regulators. For complete details on their design and construction see the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4243



Three-Phase Power Regulator

Single-Phase Power Regulator

Single-Phase Distribution Regulator

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

NEW PORTER-CABLE PORTABLE BAND SAW

CUTS METAL 15 TIMES FASTER

THAN HAND HACK SAW!

Slices through 1½" cold rolled steel in 41 seconds! That's fifteen times faster than a good man with a hack saw . . . *two-and-a-half times faster* than bulky power hack saws!

You can use this 16-pound work-demon anywhere — on ferrous or non-ferrous metals or "problem" materials. Take it into equipment yards, stock bins . . . tight spots where costly hand sawing is the only other answer. Compact, easy to handle, Porta-Band delivers smooth controlled sawing in any position. Only the cutting part of the blade is exposed. Cutting action pulls blade snugly into cut, holding saw firmly in place.

Powered for heavy duty . . . perfectly balanced . . . Porta-Band handles the toughest assignments. Band speed of 240 feet per minute insures swift, smooth cutting of all materials up to 3¼" diameter round, or 3¼" x 4¼" rectangular. Highest grade precision ball and needle bearings throughout. Aluminum alloy frame for lightness, toughness. Universal 115V AC-DC, 25-60 cycle motor (230V available at extra cost).

High or low . . . tight, awkward spots like this are easily accessible to the Porta-Band. Cuts operator fatigue, too!

On "Tailor-made" jobs, general maintenance, or tear-downs, Porta-Band does more work faster than any other tool.

Porta-Band cuts all types of cable up to 3¼" diameter. Use powerful Porter-Cable generator when current is not available.

Porter-Cable
Quality Electric Tools

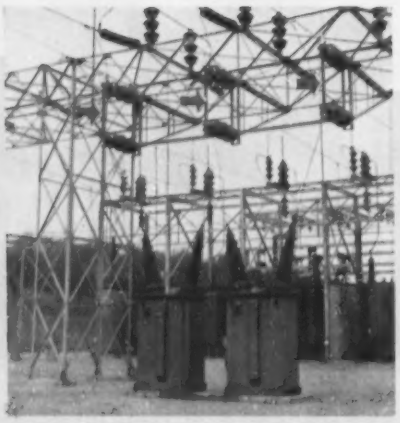
MAIL COUPON FOR FREE DETAILS

PORTER-CABLE MACHINE CO.
2163 N. Salina St., Syracuse, N. Y.
(In Canada: Send to Strongridge, Ltd., London, Ont.)
Send full information on Porta-Band and name of nearest dealer.

Name_____
Company_____
Type of Business_____
Street_____
City_____ County_____ State_____

Manufacturers of Speedmatic and Guild electric tools

S&C does it



SMD-1 Fuses have been in actual field service since March, 1952. The fuses have had many occasions to clear faults, and have done so successfully in each case.

S&C leads the way with another great advance in the fusing art—a *500,000 kva* power fuse designed for application to primaries of power transformers tapped directly on transmission and subtransmission lines; it is also designed for station service and potential transformer protection, and for sectionalizing.

Announcement of the Type SMD-1 Power Fuse comes as the culmination of many years of research, engineering, laboratory and field testing. It marks another FIRST by those who pioneered successively such fuse advances as (1) stored energy for terminal separation, (2) nondamageable fusible elements, (3) dropout action, (4) the single bore principle in boric acid fuses, (5) carbon dioxide for arc extinction, and (6) stress cones to give high external flashover characteristics.

HOW THE TYPE SMD-1 POWER FUSE EVOLVED:

S&C's fusing FIRSTS—mentioned above—brought to the industry in 1945 a million kva dropout boric acid fuse suitable for use at transmission and subtransmission voltages. This fuse—S&C's Type SMD-2—had a technical excellence equal to the most advanced types of circuit interrupting devices.

The SMD-2 engineering achievements have now been extended by development of the SMD-1 Fuse which is designed to provide protection on transmission and subtransmission systems where faults do not exceed 500,000 kva.

The SMD-1 is available in ratings at 34.5 kv, 46 kv, and 69 kv. Complete information is contained in this new Catalog Section 261 . . . available on request.

SPECIALISTS IN HIGH-VOLTAGE

again!

The New

Type SMD-1 Power Fuse

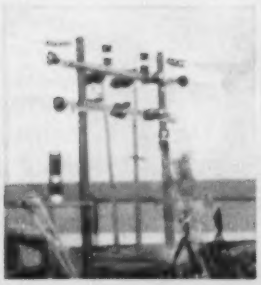
rated at

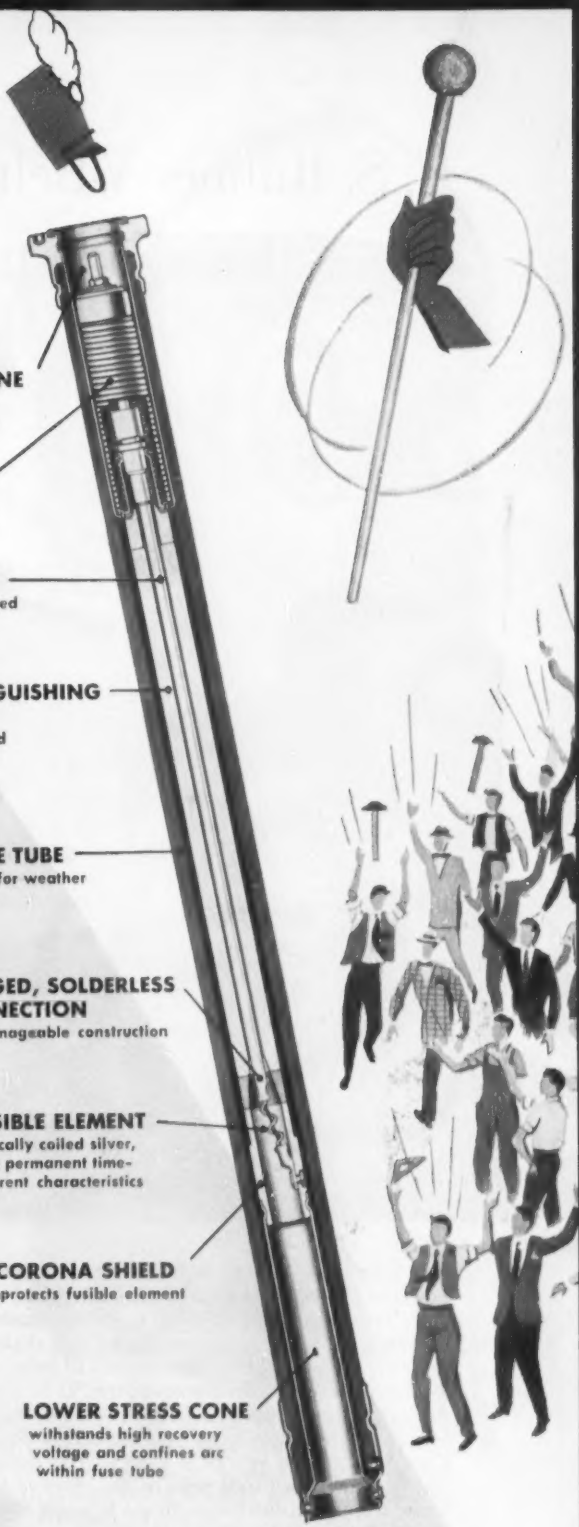
500,000 kva

3-phase

symmetrical

at 69 kv





HOW IT WAS TESTED:

Type SMD-1 Fuse has been subjected to a unique testing program. It has had not only conventional laboratory tests but also very extensive field tests under a wide variety of circuit and fault conditions. Above is a snapshot of one of the more recent tests conducted in collaboration with engineers of a large eastern utility. Maximum fault interrupted: 560,000 kva symmetrical 3-phase at 66,000 volts.

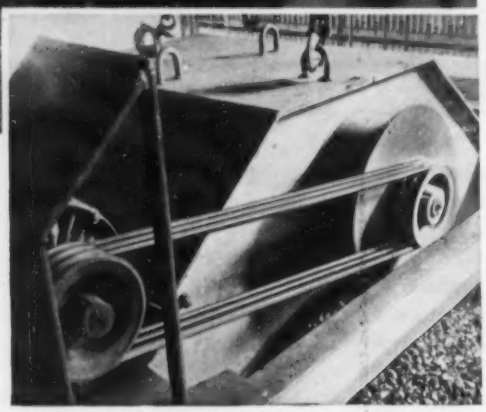
S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U. S. A.

IN CANADA: S&C ELECTRIC CANADA, LTD.
8 VANSCO ROAD, TORONTO 14, ONTARIO

CIRCUIT INTERRUPTION

U. S. Rubber V-Belts have been taking this shock treatment for over 3 years!



Two views of drive of heavy-duty coal car shakeout. This shakeout handles over 30 cars a day, is equipped with a matched set of three C-144 super-service V-belts.

The V-Belts on this coal car shakeout must transmit the power to shake the car to loosen tons of packed or frozen coal. Yet this matched set of U. S. Royal® Super-Service V-Belts has been working steadily on this shakeout *for more than 3 years*. Three other brands of belts lasted an average of only 3 weeks. Moreover, the "U. S." belts withstood the extreme shock load...never jumped the pulleys.

Part of this success stems from the unique Equa-Tensil Cord Section built into U. S. V-Belts. This development makes certain each cord pulls its *full* share of the load. Order from your distributor, or get in touch with any of our 25 District Sales Offices, or write to address below.

"U. S." Research perfects it
"U. S." Production builds it
U. S. Industry depends on it

US RUBBER

UNITED STATES RUBBER COMPANY
MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

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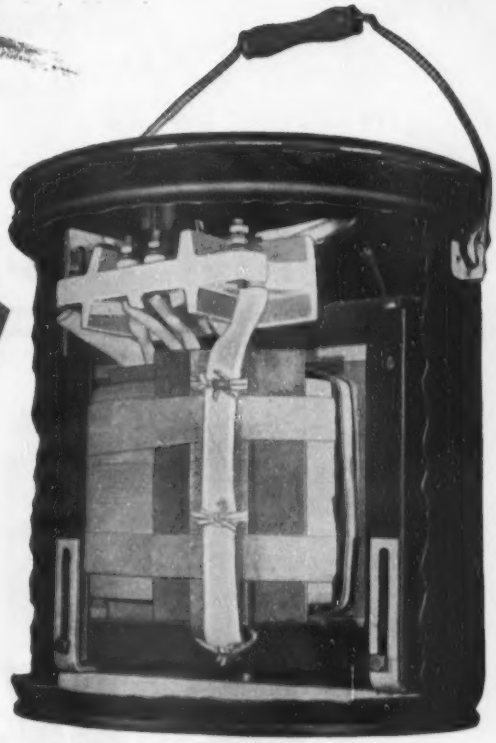
Quick repair for burned-out transformers

Wagner Replacement Core and Coil Assemblies come to you *Ready to Install*

—without testing or drying—packaged in transformer oil for complete protection



Wagner has the answer to the problem of renewing or up-rating old or burned out transformers. Specify the packaged Form W core and coil assembly . . . a brand new element, exactly like those used in new Wagner Transformers.

These replacement elements come ready for use—fully dried and tested—protected in a sealed container filled with Wagner 7-NI inhibited transformer oil, which you may also use in your tank. Available in ratings from 3 through 167 kva.

Installation is easy . . . the assemblies are complete with terminal board or tap changer, with leads ready to install in your tank. Each assembly has a new serial number and name plate.

Wagner Bushing Assemblies

High Voltage Bushing Assembly

Available in cover-mounted or tank wall mounted types to meet a wide range of requirements. Gasket, solderless connector-type terminal and clamping devices are included—fuses can be furnished when specified.

Low Voltage Bushing Assembly

Ready to install—includes porcelain bushing, gasket, solderless connector-type terminal and clamping device.

Field Repair Service for Substation Transformers

Wagner's Transformer Service Trucks—completely equipped for field repairs—each with the services of an expert—are available on schedule in most localities. The cost of this exclusive Wagner service is nominal—write for information.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

TS 53-1

PRESENTS A SPECTACULAR ADVANCE *Thompson*

IN

RIGHT-OF-WAY BRUSH CLEARANCE

BROAD SPECTRUM BRUSH KILLERS

Fortified with patented H. S. 31 to deliver extra creep for extra kill.

Thompson Broad Spectrum 2,4-D—2,4,5-T brush killers set a new standard for ease of application, more effective killing action and more economical results in brush clearance. Now your crews need no special technical skills—they simply mix and spray. Hard woods—all species—brush or weedy growth—powerful broad spectrum Thompson brush killers of controlled volatility remove the hazard of "chancey" effectiveness. Foliage spray or basal bark application, you get more kill per gallon and more gallons for your dollars.

Thompson Chemicals

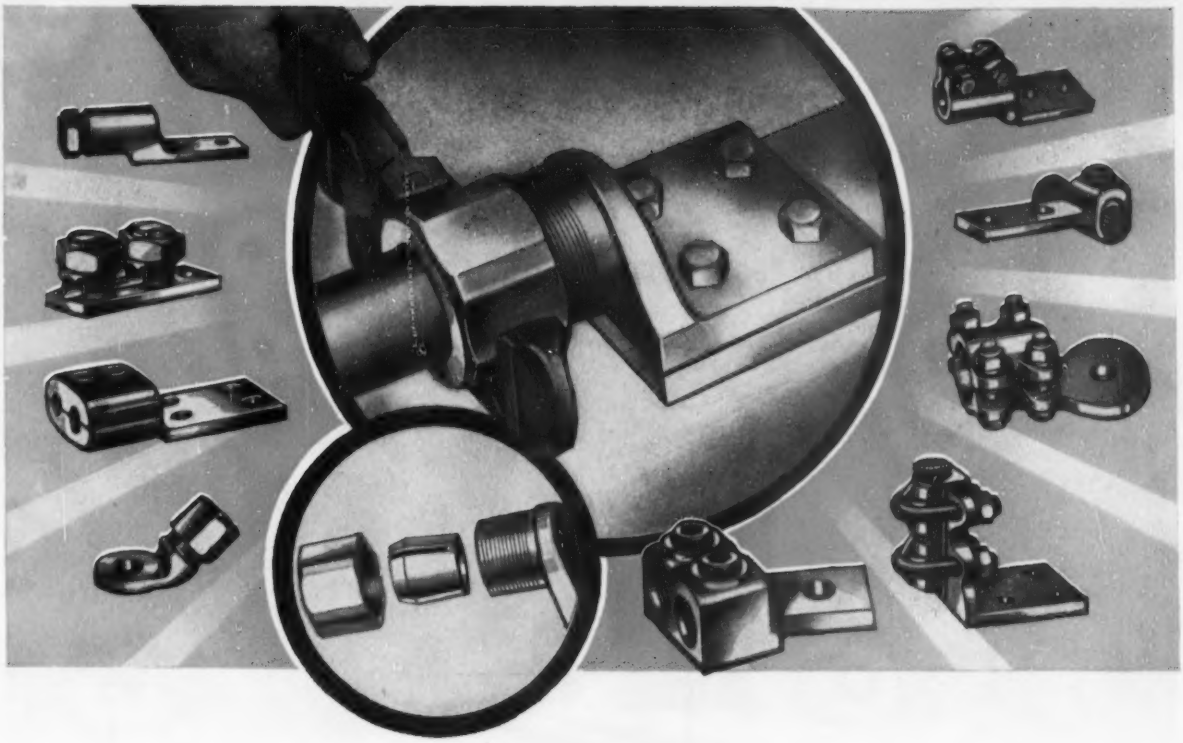
Latest technical data free. Write for station paper No. 12

Thompson **CHEMICALS CORPORATION**

3028 Locust Street, St. Louis 3, Mo.
3600 Monon Street, Los Angeles 27, Calif.

representatives in principal cities

FIRST NAME IN BRUSH KILLERS



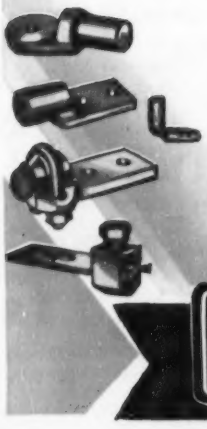
You always find the EXACTLY RIGHT TERMINAL—in the COMPLETE line

Shown above, at center, is one of the various Multi-Slit Tapered Sleeve lugs in the Penn-Union catalog. You'll also find E-Z lugs with Post-and-Nut, Vi-tite, Multifit, and numerous clamp types. These pictures can merely suggest the variety.

Below are shown Thread-On, Shrink Fit and screw types, soldering lugs, a wide selection of sheet metal terminals, etc. *Penn Union makes the terminal you need.*

Also, Tee Connectors; Cable Taps; Straight, Parallel, Elbow and Cross Connectors; Bus Suports, Clamps, Spacers; Grounding Clamps; Service Connectors, etc.

Penn-Union fittings are the choice of leading users, who have found that if *Penn-Union made it, it's dependable*—mechanically and electrically.



SOLD BY LEADING WHOLESALERS

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd.
250 Richmond St. West, Toronto

THE *Complete* LINE
OF CONDUCTOR FITTINGS

PENN-UNION

WHERE WINTER LAYS A HEAVY HAND

. . . SPECIFY WIRE COVERED WITH "BAKELITE" POLYETHYLENE

The superior electrical and mechanical properties of BAKELITE Polyethylene compounds permit smaller diameters, so line wire weighs less.

You'll find that this outstanding wire covering speeds installation—its light weight and wax-smooth surface make pulling and stripping easier. In service, BAKELITE Polyethylene won't festoon. It stays tough and flexible at –70 deg. C., resists deformation despite temperatures as high as 90 deg. C. It resists oil, grease, alkalies, most strong acids, abrasion, moisture and mildew. Tests made on the black polyethylene compound indicate a service life of several decades.

For complete information, write Dept. TZ-63. Ask for Kabelitems No. 48.

For Line Wire, Signal Systems and Service Drop—wet or dry—the power factor of BAKELITE Polyethylene (black compound) is only 0.004 at 25 deg. C; dielectric constant is 2.5. Electrical properties of BAKELITE Polyethylene Resin stay constant through a frequency range of 60 cycles to 50 megacycles. Volume resistivity is so high it can be measured only by very sensitive instruments. Voltage breakdown resistance is excellent, even after long-term water immersion.

BAKELITE
TRADE-MARK
Polyethylene
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.
In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

Instant 2-way radio communication between vehicles and headquarters boosts construction efficiency in local and outlying sections

Hartford Gas Co. headquarters maintains direct 2-way radio contact with 20 vehicles—retains effective control in emergencies

Hartford Gas Company spots fieldmen in a hurry with RCA 2-Way Radio

FOR OVER TWO YEARS the Hartford Gas Company (Connecticut) has used RCA 2-Way Radio to maintain instant, positive control of 20 vehicles —10 of them service trucks, 7 supervisors' cars, and 3 street department trucks.

Serving as a combined cost-cutter, good-will builder, and life-and property-saver, the mobile communications system *has already paid for itself* in man- and equipment-hours saved, and in extra services rendered.

The Hartford Gas Company originally adopted two-way radio to boost efficiency in handling men and materials. Gangs laying mains and running services could call the dispatcher directly to get extra equipment needed. The General Foreman could answer field foremen's questions from any location. Service headquarters could use radio to have gas turned on or off, to have trouble reports investigated, to have equipment adjusted. The quick response to customers' calls built a lot of good will.

Radio plays a big part in handling emergencies, too. Headquarters radio-dispatches repair crews as soon as troubles are reported. And whenever possible, service trucks are assigned to cover all fires reported in the city . . . turn off gas connections in and around endangered areas . . . save life and property.

Since original installation, Hartford Gas Company's RCA *Carfone* equipment (152-174 mc band) has stayed on the job day and night, giving the kind of dependable performance needed. Outage time has been next to nothing. Coverage over its 100-square-mile area is complete.

Specify RCA 2-Way Radio for dependable communications in your operation. An RCA communications specialist will be glad to talk over your requirements. Free literature noted below will give you much of the information you need. *And remember,* the RCA Service Company is in a position to provide complete installation and service . . . as it did for the Hartford Gas Company.

MAIL THE COUPON BELOW—YOU INCUR NO OBLIGATION

Radio Corporation of America
Communications Equipment, Dept. C-45, Building 15-1, Camden, N. J.
Without obligation on my part . . .

☐ Please send me booklet, "How Hartford Gas Reaches Fieldmen Fast."
☐ Please have an RCA communications specialist get in touch with me.

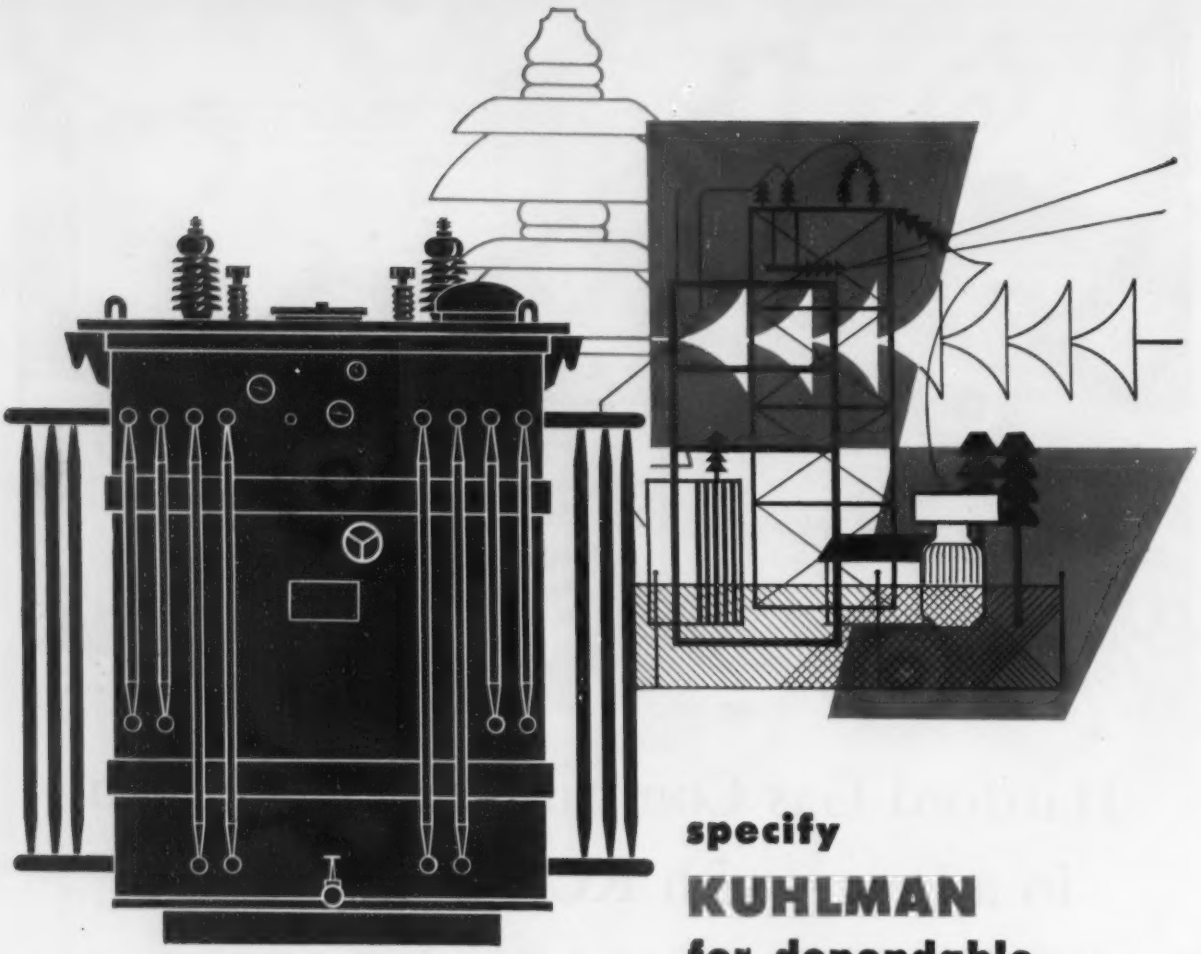
Name_____ Title_____

Company_____

Address_____ County_____

City_____ Zone_____ State_____

RCA **RADIO CORPORATION of AMERICA**
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.



specify KUHLMAN for dependable power transformers

For more than half a century, Kuhlman Power Transformers have been providing a steady and dependable source of power for American utilities and industry. Built from finest quality materials and engineered for safe, economical operation, these units incorporate the latest design principles, many of which were developed by Kuhlman. Coils are dried under heat in vacuum to insure uniformly high insulation strength and then impregnated with thermosetting varnish to provide good mechanical strength. Insulation is coordinated to the basic impulse level. Windings are equipped with wide oil ducts for insulation and ample cooling. Oil is introduced under vacuum to prevent entrapment of air and insure high insulation strength. Construction throughout is sturdy and rigid. Structural steel core clamps hold the core securely in place to prevent shifting or vibration and provide support for coil braces, lead guides and terminal structures. Tanks are constructed of heavy steel plate, and sealed to minimize deterioration of oil.

Kuhlman Power Transformers are assembled by men who are highly skilled in the electrical crafts. They are thoroughly inspected and tested to meet rigid quality standards. Kuhlman Power Transformers can be produced in a wide variety of ratings, with accessories to suit the specific needs of utilities and industries. For complete information, write for Bulletin CS-601. Kuhlman also builds Distribution, Dry Type, Saf-T-Kuhl, Subway, CSP and Series Street Lighting Transformers. Bulletins are available on these models as well.

151-T

KUHLMAN

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN • Southern Division, CRYSTAL SPRINGS, MISSISSIPPI

EXPORT REPRESENTATIVE: INTERNATIONAL STANDARD ELECTRIC CORP., 15TH FLOOR, 50 CHURCH STREET, N. Y. 7, N. Y. CABLE ADDRESS: MICROPHONE, N. Y.

SIXTY YEARS OF PROGRESS IN THE ELECTRICAL INDUSTRY

NEW NICOPRESS NO. 88 TOOL with INTERCHANGEABLE HEADS

INTERCHANGEABLE HEADS ARE QUICKLY ATTACHED

● This mechanical tool develops tremendous power by a combination of compound leverage and progressive ratcheting action. A few short strokes of the easy-working handle produce the powerful jaw pressure necessary to assure dependable full-tension splices.

Quickly-changed tool heads permit splicing a wide range of larger conductors. Write for Bulletin 88.

NICOPRESS . . . the tool and the sleeve that are made to work together . . . *together* they make the perfect splice.

Nicopress Sleeves and Tools Patented in U.S. and Foreign Countries. "Nicopress" Registered in U.S. and foreign countries.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

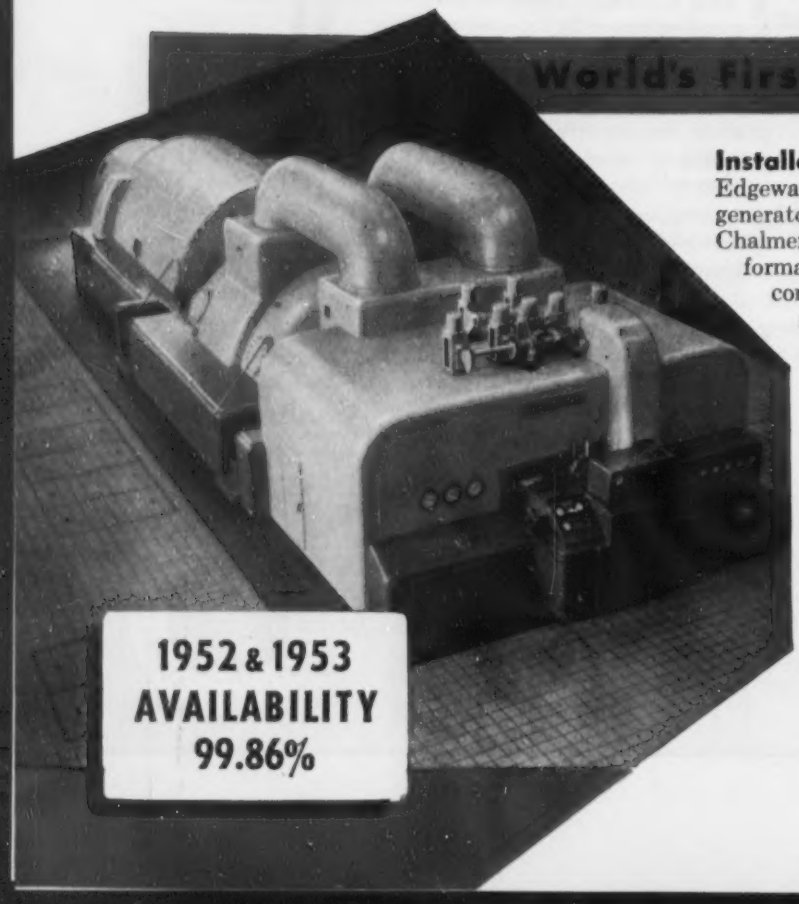
Important SUPERCHARGED

Here's what operation-proved A-C development can do for you now, and in the near future

BY CUTTING GENERATOR SIZE, *supercharged* cooling permits you to reduce plant size, lower foundation and crane costs, and use smaller breakers and bus structures. Mechanical design limitations are minimized, while possible maximum ratings are raised, and field assembly problems are simplified.

Two of the *supercharged* units now in operation are shown in the accompanying photographs. The installed units and others in various stages of production utilize direct rotor conductor cooling with high-velocity hydrogen to increase the generator rating more than 70% over conventional hydrogen cooling. Backed by experience gained from the first *supercharged* units, Allis-Chalmers is now building a *completely supercharged* generator resulting in the remarkable size reduction shown on the facing page.

For basic design information and a more detailed explanation of the many advantages of this outstanding engineering development, ask your A-C representative for the latest literature on *supercharged* cooling. Or, write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-4251



World's First Supercharged Unit

Installed at Wisconsin Power and Light Company's Edgewater Station in 1951, this 60,000-kw turbine-generator unit has proved the soundness of Allis-Chalmers pioneering engineering. Its excellent performance during the first two calendar years of commercial operation *(1952 and 1953)* can be summarized as follows:

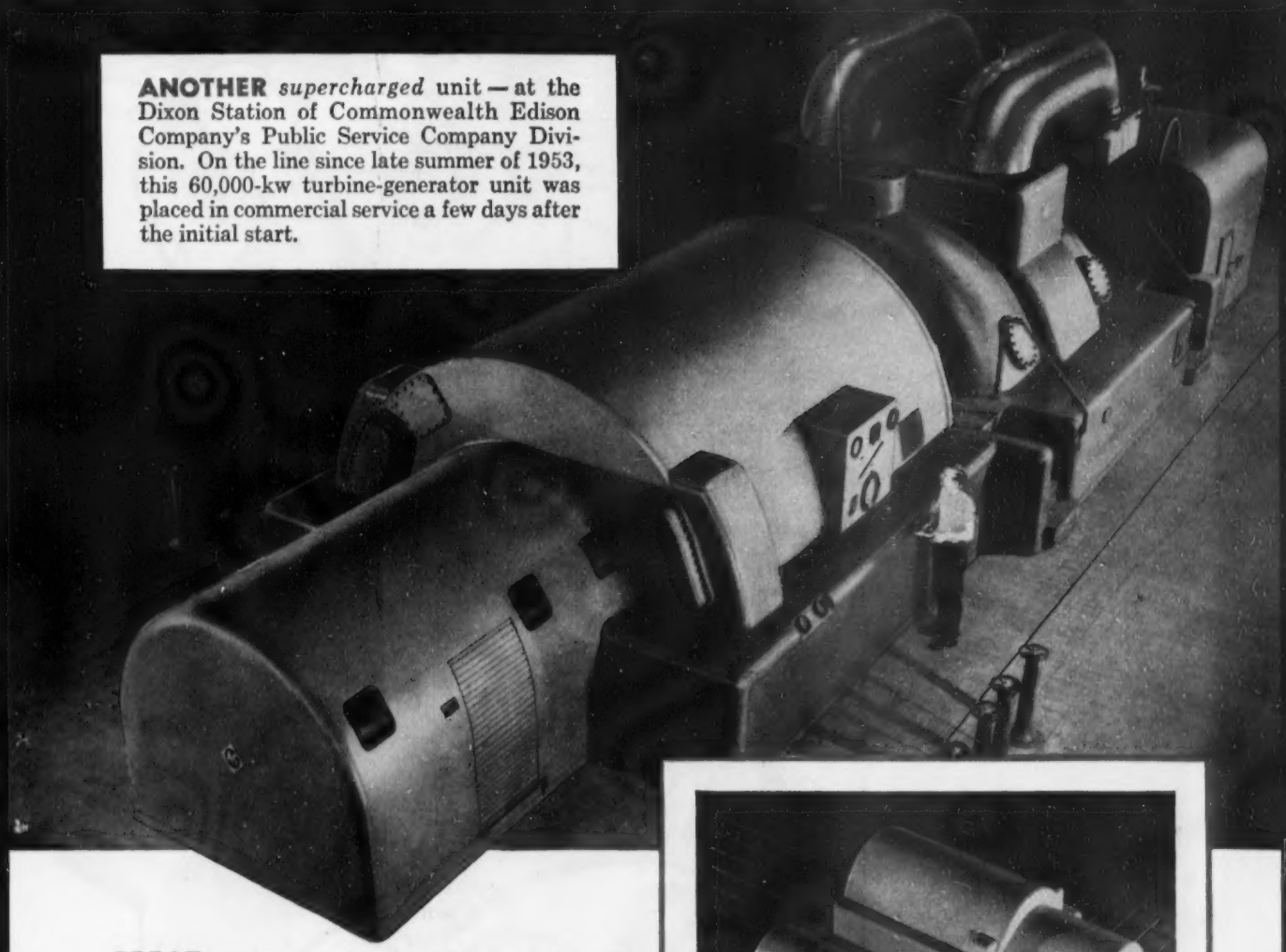
Hours in service	17,199
Service factor	98.03%
Chargeable outages	one
Availability factor	99.86%
Total generation	885,951,000 kw-hrs

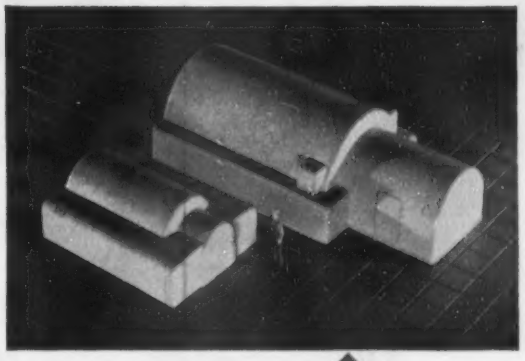
Another unit, with a *supercharged* generator but incorporating new Allis-Chalmers steam turbine design features, was placed in operation early this year at Wisconsin Power and Light Company's Rock River Station.

ALLIS-

Facts About Cooling

ANOTHER *supercharged* unit — at the Dixon Station of Commonwealth Edison Company's Public Service Company Division. On the line since late summer of 1953, this 60,000-kw turbine-generator unit was placed in commercial service a few days after the initial start.



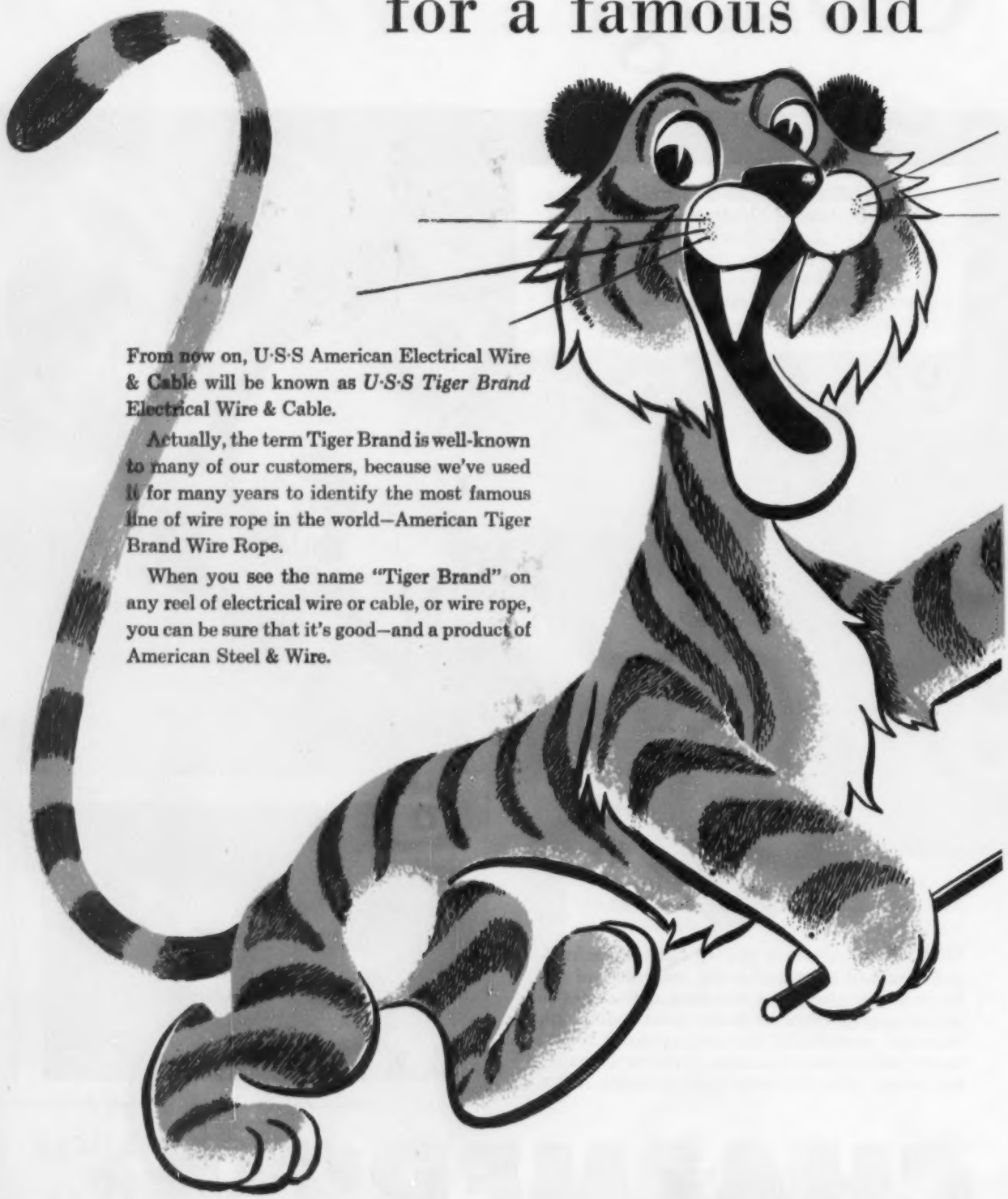


GREAT difference in size of *fully supercharged* and standard hydrogen-cooled generators of same kw rating suggests the increased advantages full supercharging offers in power plant space, crane capacity, quantity of gas, cooling water requirements, differential expansion, shipping clearances, and many other first-cost and operating factors.

CHALMERS

A-C ALLIS-CHALMERS

a brand new name for a famous old



From now on, U·S·S American Electrical Wire & Cable will be known as *U·S·S Tiger Brand* Electrical Wire & Cable.

Actually, the term Tiger Brand is well-known to many of our customers, because we've used it for many years to identify the most famous line of wire rope in the world—American Tiger Brand Wire Rope.

When you see the name "Tiger Brand" on any reel of electrical wire or cable, or wire rope, you can be sure that it's good—and a product of American Steel & Wire.

line of wire and cable

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

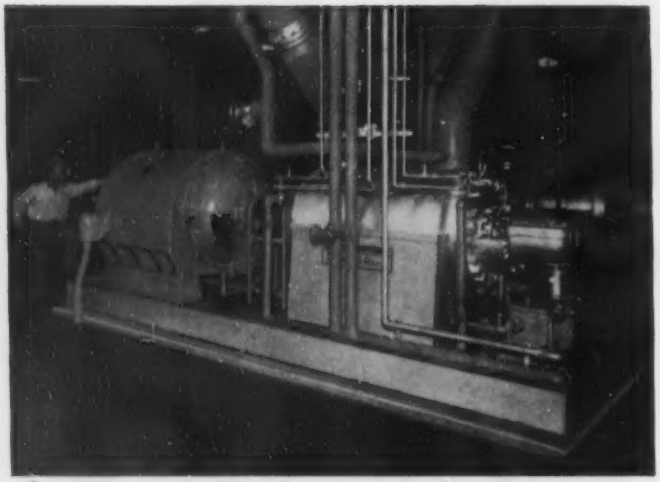
UNITED STATES STEEL

Contributing to the

of New England Electric System's

Ingersoll-Rand

CONDENSERS AND ACCESSORIES
BOILER FEED PUMPS
GENERAL SERVICE PUMPS
SOOT BLOWING COMPRESSORS



One of six Ingersoll-Rand 9-stage double-case boiler feed pumps serving the Salem Harbor Station. A 4th stage take-off delivers 778 gpm at 2170′ total head for attemperating service. The last 5 stages deliver 730 gpm at 2620′.

New England Electric System's Salem Harbor Station at Salem, Mass. is a fine example of the best in modern central station design. New England Power Service Company and United Engineers and Constructors, Inc. collaborated on the station's design, the latter firm doing the construction.

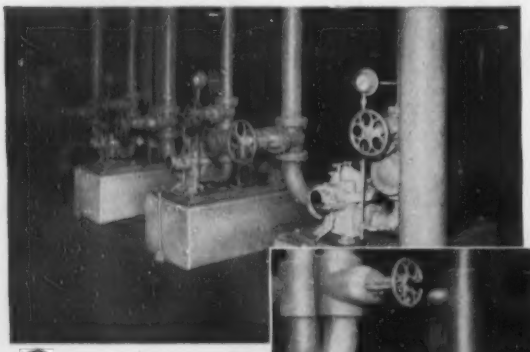
This station combines high operating economy with maximum continuity of service. That calls for *proved* economy and dependability in every item of equipment in this 150,000 kw plant.

That's why Ingersoll-Rand is pleased to have been called on to supply so much of the auxiliary equipment serving both units at Salem Harbor Station. Major items of this equipment are shown in the accompanying photos.

For *dependability*, operating economy and low maintenance, it pays to install Ingersoll-Rand central station auxiliaries.

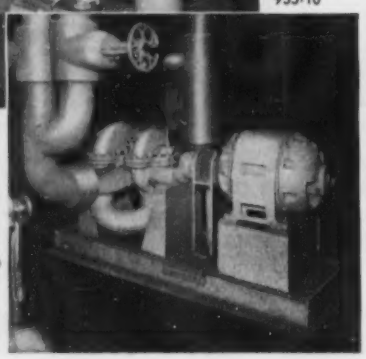
Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.



Three I-R single-stage general service pumps supply cooling water for various station equipment.

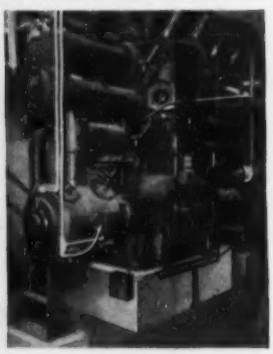
933-10



This I-R two-stage pump, rated at 1500 gpm and 270′ total head, is on city water booster service.

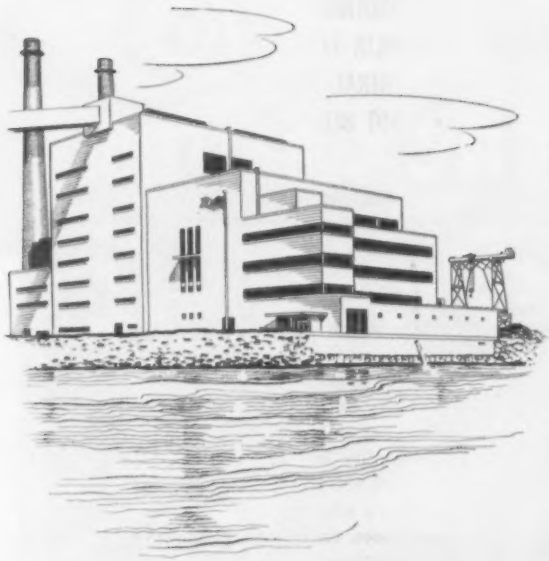
Two I-R two-stage, vertical turbine pumps handling service water.

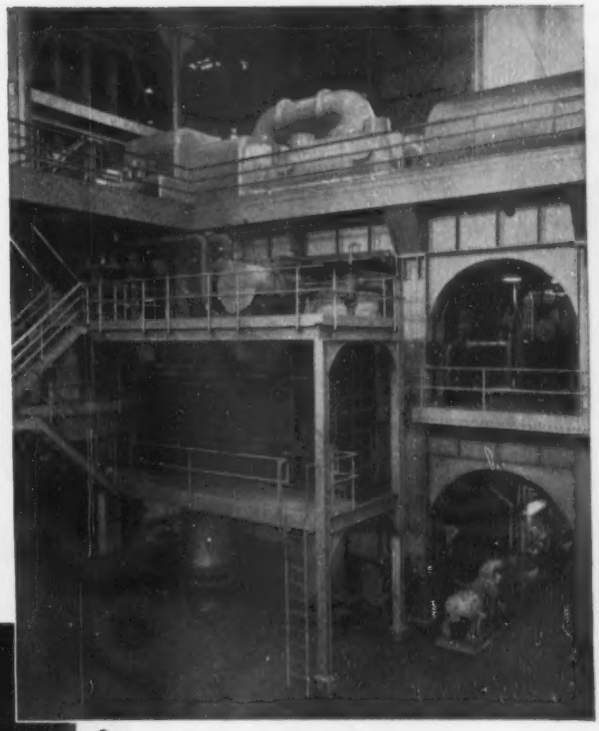
One of three I-R Class TVH 3-stage, 500 psi soot blowing compressors.



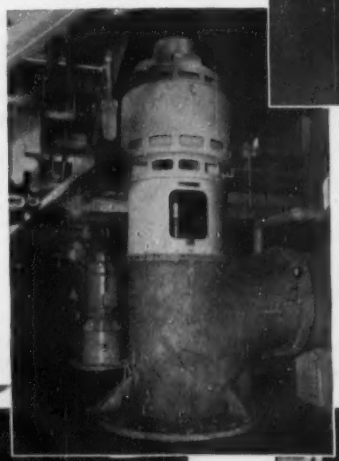
Dependability

SALEM HARBOR STATION





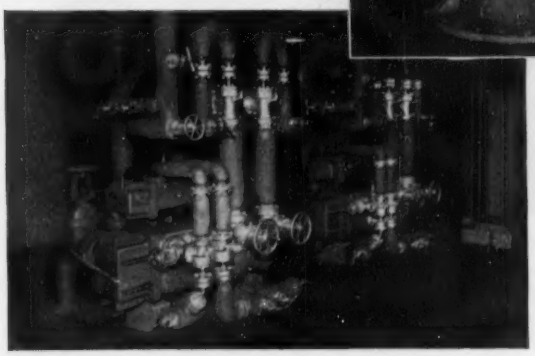
Unit 2 of the Salem Harbor Station, showing the 47,500 sq. ft. I-R rectangular steam condenser under the 75,000 kw turbo-generator. A duplicate condenser serves Unit 1.

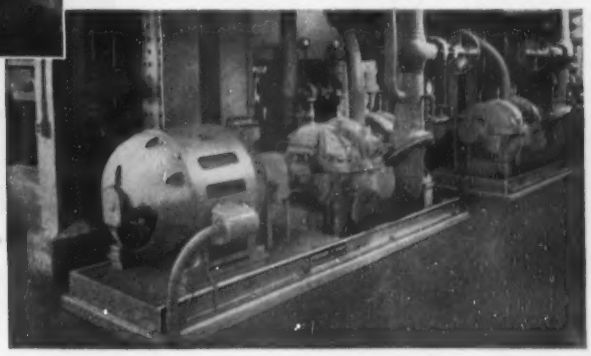


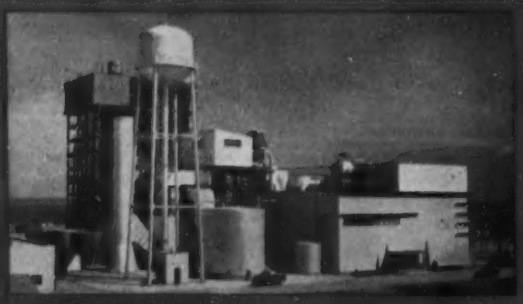
One of four I-R single-stage vertical condenser circulating pumps which each deliver 54,000 gpm to the condensers at Salem Harbor.

These two-stage steam jet air ejectors remove non-condensables from the steam condenser for Unit 2.

Two of the four I-R horizontal condensate pumps which serve the two condensers at the Salem Harbor Station. Each pump is rated 1,000 gpm, 465' total head and 1180 rpm.







SOUTHWESTERN PUBLIC SERVICE CO.—*another user of*

Exide-Manchex BATTERIES

In the wide open spaces of Lamb County, Texas, lies Plant X, newest of Southwestern Public Service Company's power plants, and one of 11 with which the company provides dependable electric service for its Tri-state area.

Throughout America, more and more power stations are using Exide-Manchex batteries. They assure:

POSITIVE OPERATION: Dependable performance at ample voltage avoids switchgear operational failures.

INSTANTANEOUS POWER: High rates for switchgear and valve operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

Various sizes and types of Exide Batteries are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation service.

Installation showing one of two 60-cell EME-17 Exide-Manchex control batteries in the Lamb County power plant.

1888...DEPENDABLE BATTERIES FOR 66 YEARS...1954

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*

"EXIDE" and "MANCHEX" *Reg. T.M. U.S. Pat. Off.*

Here's proof...

G-E 2-WAY WILL PERFORM IN ANY CIVIL DISASTER!

● Civil defense authorities throughout the nation agree that successful programs must include dependable radio communication. The system has to function before, during and after an emergency. Well, G-E Mobile Radio does exactly that . . . and it can be proved!

Note the experience encountered by Tennessee's State Highway Patrol. The car pictured above was caught in a cyclone near Dyersburg . . . turned up on end . . . spun around several times . . . then hurled 1200 feet. An examination of its General Electric mobile transmitter after the disaster showed *just one tube broken and still capable of operation.*

Make this superior communications equipment *your* first line of defense. Buy only General Electric!

You can put your confidence in—

GENERAL ELECTRIC

2-WAY MOBILE RADIO

General Electric Company, Section X1934-8
Electronics Park, Syracuse, New York

Please have a Communications Counselor call at my office.

NAME .....

ADDRESS .....

CITY ..... STATE .....

NEW UTILITY STATIONS C-E EQUIPPED

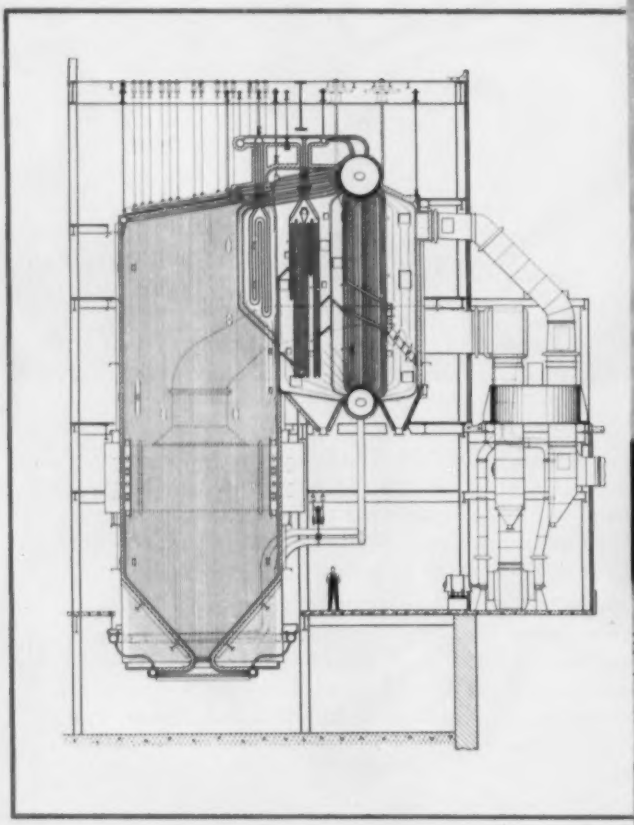
Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA • AURORA
HENNEPIN • EASTLAKE
OAK CREEK

SUWANNEE RIVER

URQUHART
SANDOW
KINGSTON
BARRY
MULLERGREN
NORTH OMAHA
SAGUARO
MILLIKEN
NELSON
WILMINGTON
JOHN SEVIER
VERMILION
GALLATIN
BARRETT
CARBON

The C-E Unit shown below is now in service at the new Suwannee River Plant. It is a C-E Vertical-Unit Boiler, Type VU-50X, with a 2-stage superheater, and has a regenerative type air heater following the convection surface. The unit is equipped with tilting, tangential burners and is designed to burn oil, with provision for the future use of natural gas and coal. Maximum continuous capacity is 350,000 lb of steam per hr at 900 psi and 900 F.



COMBUSTION

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

NEW SUWANNEE RIVER PLANT
goes into service

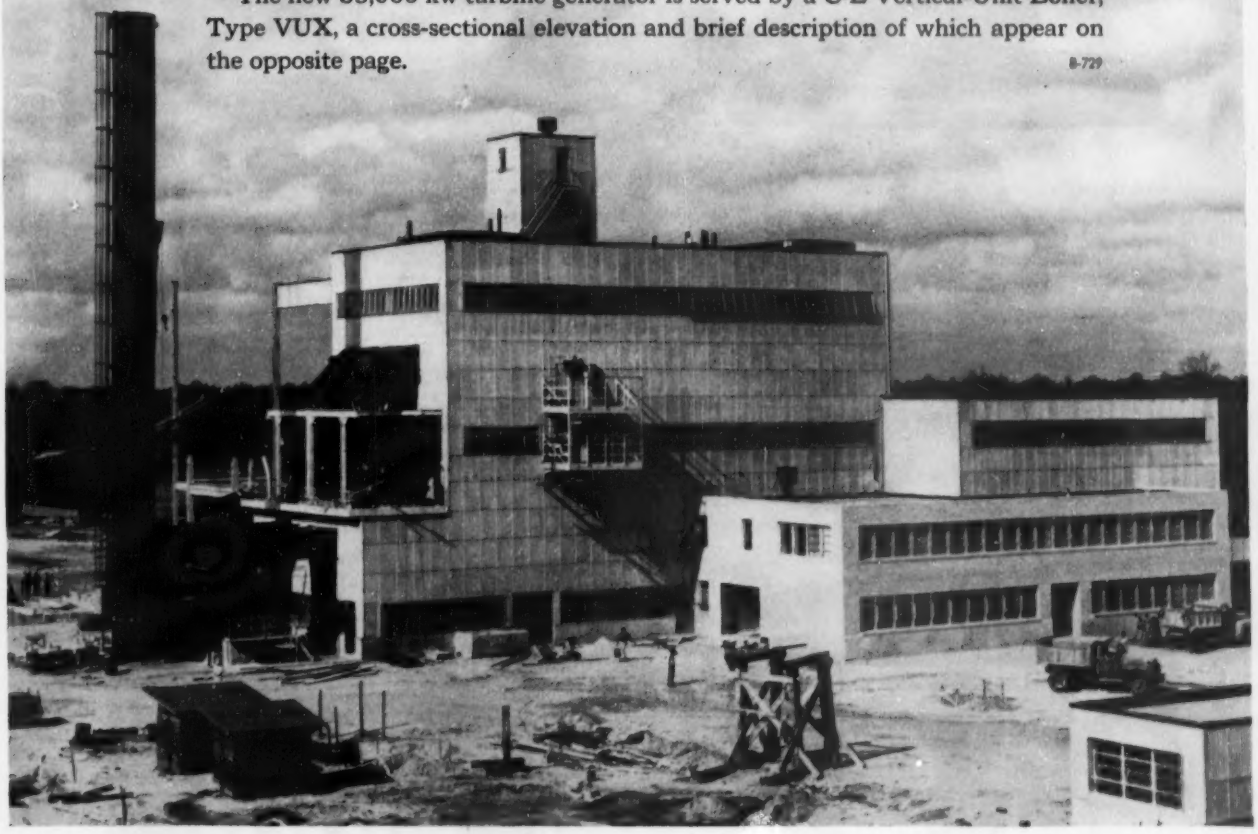
The Florida Power Corporation added a very important link to its lengthening chain of electric generating facilities when the new Suwannee River Plant went into service recently at Ellaville, Florida.

Strategically located on the historic Suwannee River on the northern end of the system, this new station will not only serve a rapidly expanding area in and around the city of Madison but will supply a considerable amount of power to the Company's wholly owned subsidiary, the Georgia Power & Light Company.

The Suwannee River Plant, which is of the semi-outdoor type, was designed by Florida Power Corporation engineers in collaboration with Black & Veatch, Consulting Engineers.

The new 33,000 kw turbine generator is served by a C-E Vertical-Unit Boiler, Type VUX, a cross-sectional elevation and brief description of which appear on the opposite page.

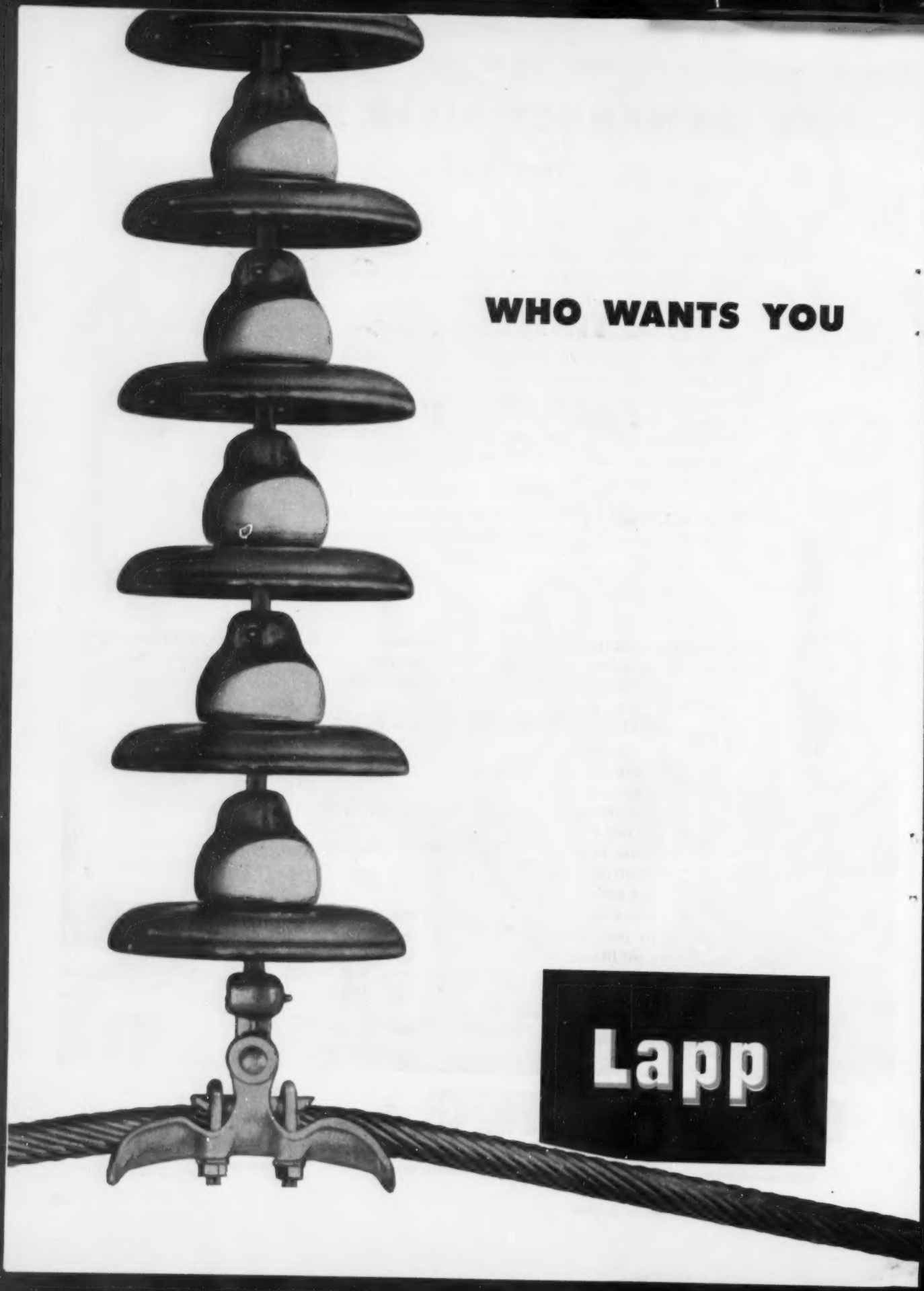
B-729



ENGINEERING, Inc.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

C-E


WHO WANTS YOU
Lapp

TO THINK THAT "ALL SUSPENSION INSULATORS ARE ALIKE"?

You probably have been told that performance characteristics of various makes of suspension insulators are so nearly alike that it makes little difference which go on your lines. It is true that all "standard" 15,000-lb. suspension discs are of the same diameter. Under the NEMA standardization program, they are similar in appearance. Leakage distances are about the same. Strength ratings are indentical. It is also true that, because of purchases made on a "specification-price" basis, large individual orders have been filled with designs for which there is little experience of service.

Do these similarities wash out all important differences in insulator performance? Lapp certainly does not think so! In fact, we back up our belief with thousands of dollars monthly. We don't think there has ever been much doubt about the ability of any Lapp suspension insulator to meet the "specification"—yet we continue a dozen or more expensive programs of research, development and control. These include design, raw material, manufacture and testing—and they involve electrical and mechanical performance of porcelain, hardware and assembly. They're worth what they cost, because they assure a difference in performance and dependability for Lapp insulators.

We suspect that the advantage in the belief that "all suspension insulators are alike" is only to the maker of a product which can't compete on a quality or performance basis.

Nobody will offer you a cut-price on Lapp suspension insulators. What we do offer you is a chance to join that select circle of informed and careful buyers who recognize in Lapp suspension insulators the industry's best bargain in operating safety and security . . . long life . . . and low upkeep.

Lapp Insulator Co., Inc., LeRoy, N. Y.

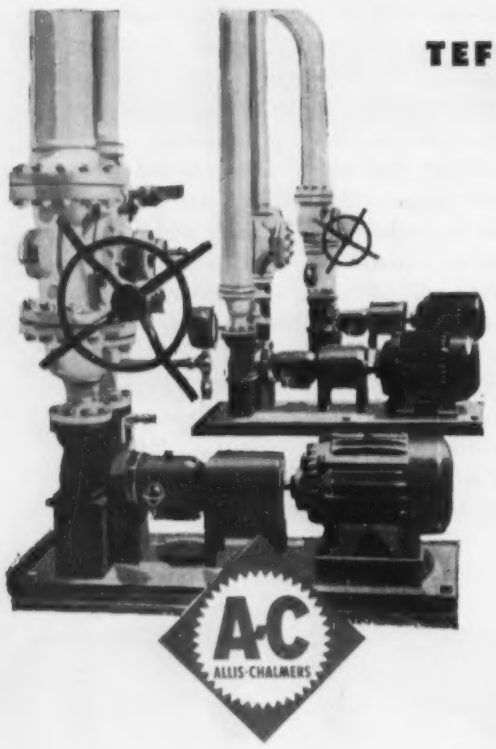
GREATER PROTECTION AGAINST FOREIGN MATTER—LONG

new motors - new

OPEN—DRIP-PROOF

Here are a few of the reasons why the new Allis-Chalmers open—drip-proof motor in NEMA rerate sizes will give you better performance and lower maintenance costs in general-purpose applications.

- Better protection against falling water and debris because cooling air inlets are on bottom.
- Long bearing life because large grease chambers provide plenty of reserve lubricant and are thoroughly sealed against foreign matter.
- Quieter operation, smoother performance.



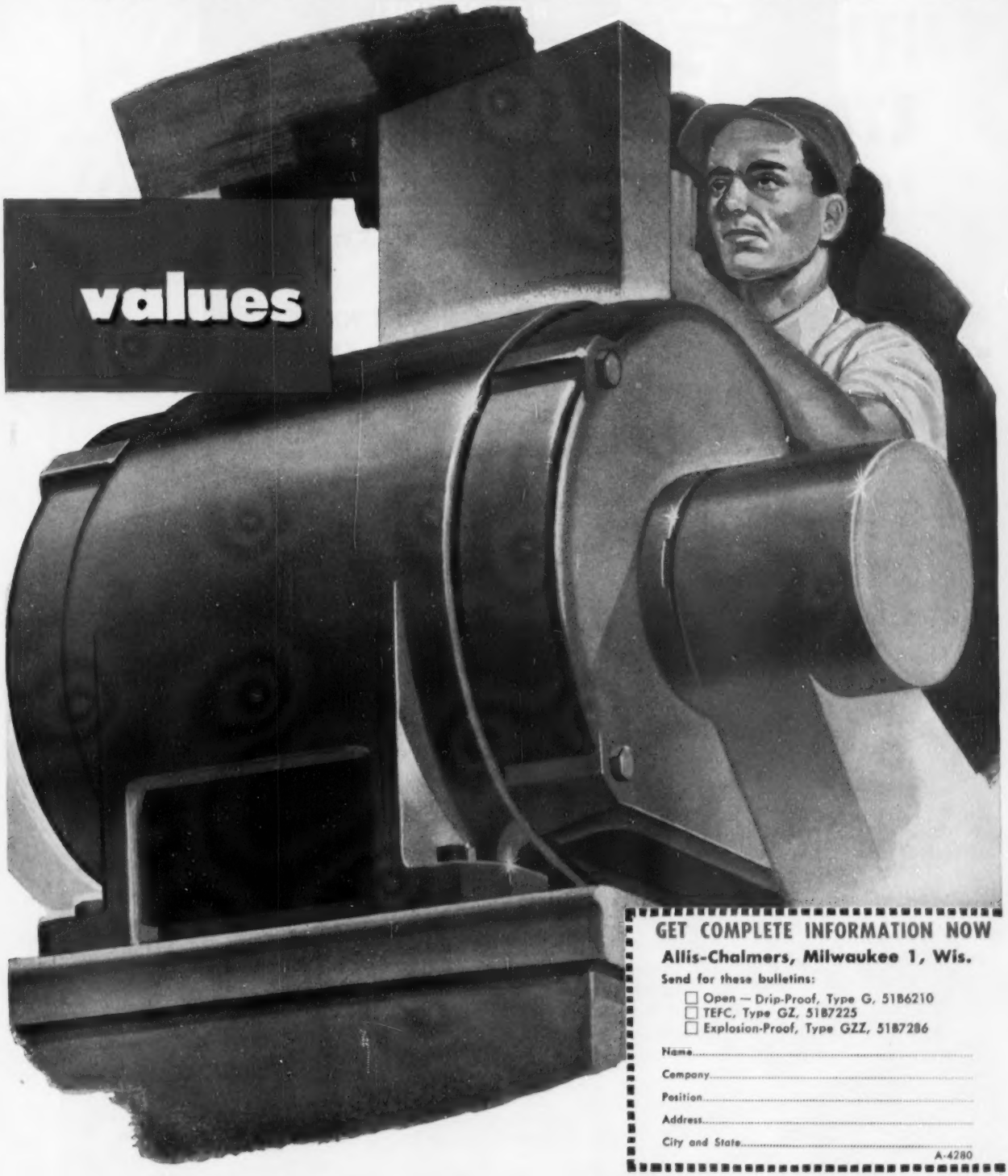
TEFC and EXPLOSION-PROOF

For especially dirty, corrosive or hazardous applications, you will get top performance with low maintenance costs from the new Allis-Chalmers totally-enclosed, fan-cooled and explosion-proof motors in NEMA rerate sizes. Here are a few of the reasons:

- Foreign matter kept out of bearings and motor interior by double labyrinth seals inside and outside of bearings, and long running fits between shaft and seals.
- Bearing maintenance reduced because large grease chambers provide space for reserve lubricant; also, if required, grease may be renewed without dismantling.
- Easy to clean — no inaccessible air passages. Dirt wipes or blows off easily.

ALLIS-

LIFE BEARINGS—MANY TRIED AND PROVEN FEATURES



GET COMPLETE INFORMATION NOW

Allis-Chalmers, Milwaukee 1, Wis.

Send for these bulletins:

- ☐ Open — Drip-Proof, Type G, 5186210
- ☐ TEFC, Type GZ, 5187225
- ☐ Explosion-Proof, Type GZZ, 5187286

Name.....

Company.....

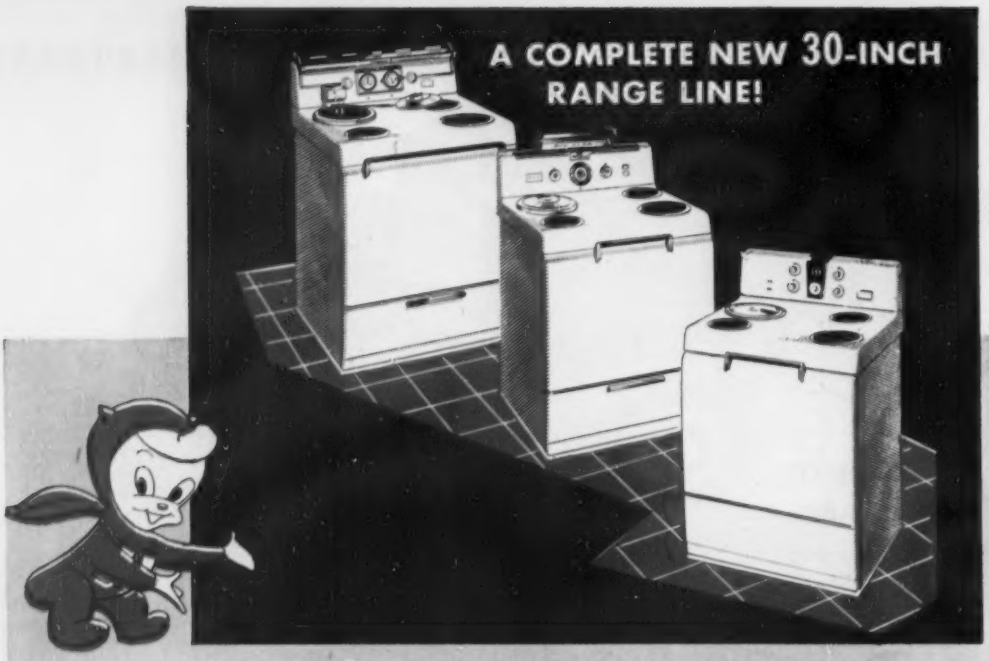
Position.....

Address.....

City and State.....

A-4280

CHALMERS



Hotpoint

Opens New Fields of Utility Revenue with a Complete, New 30-inch Range Line

Already recognized as the leader in the appliance business, Hotpoint scores *another* first with the complete, feature-packed Super-30 Range line. This new Super-30 line will add countless new customers to utility lines.

Now the many families who liked the idea of a smaller electric range can buy one without sacrificing the wonderful de luxe features which make electric ranges so desirable. This, plus the fact that Hotpoint's Super-30 line offers a range to suit every family budget, means that utility revenues will be greatly increased.

Skillful engineering has enabled Hotpoint to turn out Super-30's with all the features of full-sized ranges. There is a de luxe feature for every one of the compact 30 inches. For instance . . . the Rota-Grill for country-style barbecuing, Deep-Well Thrift Cooker, Lighted Pushbuttons, and many others.

Have your Hotpoint distributor give you the facts on the complete Super-30 line. Learn today's opportunities for sales PLUS the future utility revenue which will result from this new Hotpoint line.

Again Hotpoint *looks at Tomorrow, Today*

HOTPOINT Co. (A Division of General Electric Company) 5600 West Taylor Street, Chicago 44, Illinois

THIS OIL PURIFIER NEVER QUITS ON THE JOB!

SPECIAL FEATURE OF THE DE LAVAL PORTABLE OUTFIT	WHAT THIS MEANS TO THE POWER ENGINEER
✓ A De Laval Portable Outfit operates at constant high purifying efficiency. It need not be shut down during a run for renewal of essential parts.	✓ A greater output of dehydrated insulating oil obtained at maximum operating economy.

Constant high purifying efficiency–no shutdowns for cleaning or for renewal of parts during run ✓

Dehydrates at a single pass–no re-running

Higher daily capacity of insulating oil saves maintenance costs ✓

Heater cannot carbonize the insulating oil

Safest–continuous discharge of water prevents re-contamination of the insulating oil ✓

Centrifugal purifier is economical to operate

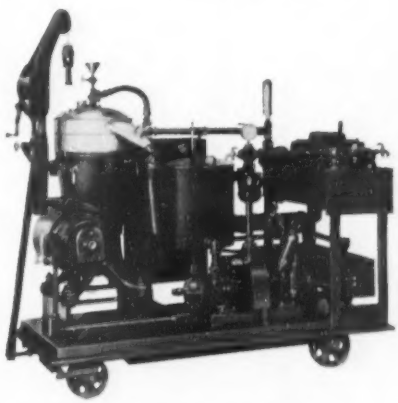
Removes free water without aid of filter press; press used only to remove colloidal carbon ✓

Low temperature purification; high dielectric value of oil maintained longer

Of all the ways there are to purify insulating oil, none is more safe and sure than the De Laval centrifugal method. De Laval Insulating Oil Purifiers promptly and continuously separate oil and water by applying centrifugal force in the bowl of the Purifier. So thorough is this method of purifying oil that not so much as one part of water in 100,000 of oil will remain after purification.

Moreover, De Laval Oil Purifiers remove water at constant high efficiency. No shutdowns are required during the course of a run for cleaning or for renewal of functional parts. This results in time saved and lower operating costs.

Ask for Bulletin TR-1.



✓ CHECK THESE DE LAVAL SUPERIORITIES

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL

INSULATING OIL PURIFIERS

LOCKE announces advance in

MICRO SUSPENSION

Now the originators of Compression Glaze give you MICROGLAZE SUSPENSION INSULATORS . . . made possible by new Locke discoveries in the all-important porcelain glazing process.

A porcelain insulator's ability to resist impact varies with glaze thickness. Too much glaze . . . or too little . . . will not let the porcelain develop its full potential strength. On MICROGLAZE Insulators, glaze thickness is held within what Locke research has proved to be a *Range of Peak Strength* where resistance to mechanical impact is greatest.

This means that when you order MICROGLAZE SUSPENSION INSULATORS, whether by hundreds or thousands, you can be sure of uniform glaze thickness throughout . . . plus smooth appearance and peak strength.

So let Locke MICROGLAZE Insulators help you fight mechanical impact. No extra cost . . . *but you get so much more for your insulator dollar!*

Suspension Insulator Engineering

GLAZE* INSULATORS

Write today for new 8-page folder titled "The Story of Microglaze Insulators"

LOCKE

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

*Trademark of General Electric Company

Illustration, courtesy of American Iron and Steel Institute

HOT-DIP GALVANIZING—THE PROTECTIVE COATING THAT HAS NEVER BEEN SURPASSED!

Good conduit makes the job so much easier. Triangle Rigid Conduit is made of the highest grade steel.

IN ADDITION—99.9% PURE MOLTEN ZINC, PROVEN THROUGH THE YEARS AS THE FINEST PROTECTION, IS USED INSIDE AND OUTSIDE THE CONDUIT.

It's easier—and less expensive—to specify the best. Ask your electrical distributor—he knows, if it's Triangle—***IT MUST BE RIGHT!***

The Trade Mark of Top Quality

TRIANGLE

IT MUST BE RIGHT

Manufacturers of Arteries for electricity, liquids and gases.

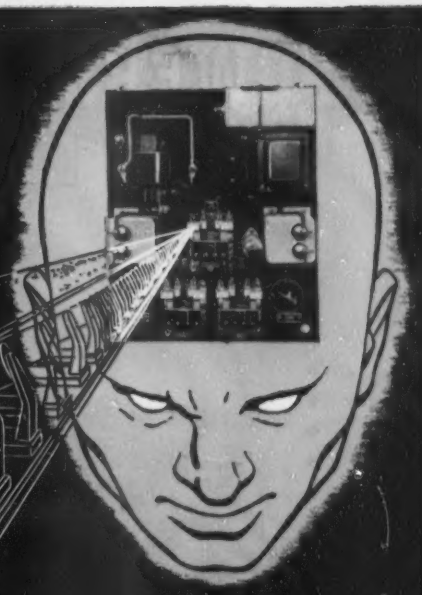
WIRE • CABLE • CONDUIT • PLASTIC PIPE • BRASS & COPPER TUBE

TRIANGLE CONDUIT & CABLE CO., INC.

New Brunswick, N. J. • Moundsville, W. Va.

Electronic Brain

CONTROLS WORLD'S LONGEST SINGLE-FLIGHT CONVEYOR BELT!*



*11,000-foot rubber belt in mile-long conveyor handles coke between coking plant and blast furnaces at large eastern steel mill.

In this installation, the NEO-TIME CURRENT ELECTRONIC ACCELERATOR (in white circle) is shown on an EC&M 150 h. p. 440-volt starter.

EC&M AUTOMATIC ACCELERATOR MODIFIES TIME BY MOTOR CURRENT TO COMPENSATE FOR LOAD AND WEATHER CONDITIONS

THE EC&M NEO-TIME-CURRENT METHOD OF ACCELERATION is not just time limit or current limit . . . it actually combines the advantages of both to give positive acceleration modified by load conditions. As its name implies, it is inherently self-adjusting and automatically provides for (1) fast acceleration of an empty belt on a hot day and (2) slow acceleration of a loaded belt under icy conditions.

NEO-TIME-CURRENT STARTER FEATURES:

1. It permits use of single motor-drive on long conveyors.
2. Belt stretching is controlled within safe limits during acceleration.
3. Convenient adjusting dials can be set for slow start during break-in period and then gradually changed to give most efficient acceleration for best operation.
4. After tune-up, further manual adjustment is eliminated by automatic self-adjusting characteristic of the Neo-Time-Current.

For Details and Specifications, Write Today for Booklet 1041.

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET • CLEVELAND 4, OHIO

POWERS American SERVICE BODIES AND EQUIPMENT

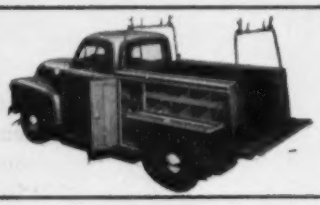
The 1 Source
for utility bodies and equipment!

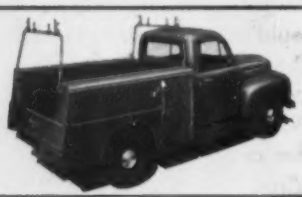
If your work calls for one service body or a hundred . . . if you can use standardized units or require custom-made equipment . . . you'll find a body to fit your needs in the Powers-American line. Ladders, reels, racks, hooks, brackets, shelves, and other special items of equipment, can be furnished for your particular work requirements.

May we help you with your service body problems? Complete details will be sent upon request.

Series 44L and Series 44 (shown above) designed for any general service work. Fully-equipped with shelves and bins. For ½, ¾, 1, and 1½ ton chassis.

Series 25T and 35T arranged for telephone installation and service. Widely used in other phases of utility work. Available in ½ and ¾ ton sizes.





Series 25M and 35M used for all types of general service. Especially suitable for electric meter installation and maintenance. Models for ½ ton and ¾ ton vehicles.

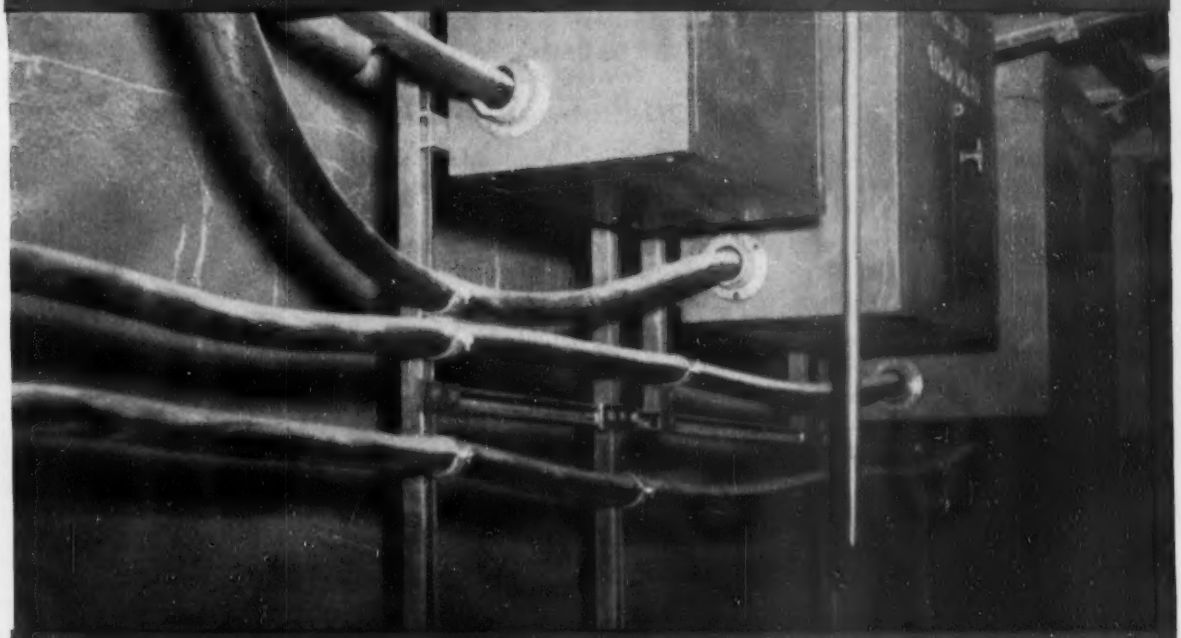
Series 25G and 35G designed for use in the installation and servicing of gas meters. Equipped with meter hold-downs, bins, and pipe rack. In ½ and ¾ ton sizes.

POWERS-AMERICAN DIVISION

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO.
428 LATHAM SQ. BLDG. • OAKLAND 12, CALIF.

SEEN



but not heard (from)

A lot depends upon a trustworthy high voltage distribution system. Should this cable carrying 4160 volts from substation to circuit breakers fail, the cost in terms of lost production and work hours would far exceed the price of a new cable.

However, the chances of this cable failing are almost negligible. Why? Because it's a Simplex high voltage feeder cable. It's insulated with the famous Anhydrex XX insulation.

If your high voltage cable insulation is extremely resistant to heat and aging, is not affected by ozone, and is guaranteed not to absorb more than 15 milligrams of water per square inch when soaked for 7 days at 158° F., you're paying for ordinary insulation. If it offers this guarantee *AFTER* being aged for 7 days at 250° F., you're getting the best insulation — Anhydrex XX.

Insulation with a low water-absorption and oxidation rate stands a better chance of keeping its electrical properties, thereby assuring longer service. That's what you want in high voltage feeder cable. That's what you get with Simplex-Anhydrex XX. Write for bulletin Number 1009-A.

Simplex–ANHYDREX XX

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

NEW INTERNATIONAL MEDIUM-DUTY FOUR-WHEEL DRIVE TRUCKS

For Off-Highway or Highway Operation

Now, INTERNATIONAL Truck advanced engineering makes possible another development in transportation efficiency—*two new medium-duty four-wheel drive models* that open new possibilities for truck operators in scores of fields.

You can haul men, tools, equipment to any job—through mud, sand, and snow—over terrain where conventional trucks can't go. With front axle disengaged, you can operate normally on the highway.

Tough-job engineered. These new models are built for the toughest kind of work. Like every INTERNATIONAL, they give the low operating and maintenance cost and long life that have made INTERNATIONAL the heavy-duty sales leader for 21 straight years.

These new INTERNATIONAL 4x4 models have the stamina, ruggedness, and versatility for the toughest jobs. See one today. See how it fits your work. Time payments arranged. See your INTERNATIONAL Dealer or Branch for all the facts.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

New INTERNATIONAL R-160 (4x4) with public utility equipment, including front-end winch. GVW rating, 11,000 lbs. Famous Comfo-Vision cab.

Brief Specifications of these new INTERNATIONAL medium-duty 4x4 models

Two chassis models. Model R-140 (4x4)—130-inch wheelbase, 60-inch CA; 142-inch wheelbase, 72-inch CA, GVW rating 11,000 lbs. Model R-160 (4x4)—154-inch wheelbase, 84-inch CA; 172-inch wheelbase, 102-inch CA, GVW rating 15,000 lbs.

All-truck power. Model R-140 (4x4), 100-hp. Silver Diamond 220 valve-in-head engine. Model R-160 (4x4), 108-hp. Silver Diamond 240 valve-in-head engine.

Eight forward speeds, two reverse. Transmission has four forward speeds, one reverse, with 2-speed transfer case.

Easily converted for highway use. Special transfer case permits disengaging front axle for normal 2-wheel drive operation.

Transmission power take-off openings on right and left side to handle front-mounted winch.

International Harvester Builds **McCORMICK**® Farm Equipment and **FARMALL**® Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

Better roads mean a better America

INTERNATIONAL® TRUCKS

"Standard of the Highway"

1. Variac to control output voltage.
2. Range Switch transfers microammeter from 50 to 1000 microamperes range.
3. Guard Switch for by-passing stray currents to ground.
4. Neon Bulb protects against continuous overload.
5. Dual Range Microammeter measures leakage current.
6. Kilovoltmeter measures output voltage.
7. Calibration Curves translate microamperes into ohms resistance.
8. Power Switch (on-off control).
9. Grounding Post insures protection to operator.
10. Indicator Light (power on or off).
10
4
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7

L-M DC Insulation Tester, being used to check insulation on a Kyle Type H Recloser.

L-M's New DC Insulation Tester Assures More Positive Maintenance For Reclosers

New portable unit operates on 120 volts, 60 cycles; requires low input power; is easily handled by one man. Use of DC gives high degree of accuracy, tells relative strength of insulation, and avoids useless replacement of good insulation. Completely protected so the device cannot be damaged by a short circuit; can measure any part of a number of insulation paths, one stringer or an entire recloser. Costs only $375.

L-M's new DC Insulation Tester is a highly efficient, low-priced portable unit that provides accurate determination of the condition of insulation in reclosers or other apparatus.

With this tester you can greatly improve recloser maintenance. It avoids replacement of insulation that is still in good condition; and it indicates when insulation should be replaced so that a recloser with faulty insulation is not put back on the line.

It may be hooked up to test the complete apparatus, or just one stringer in the unit.

It measures the DC insulation resistance of the entire apparatus or any part, at test voltages from 1 KV to 15 KV DC. It operates instantly, there being no vacuum tubes requiring a warm-up period.

Leakage current is measured by a dual range microammeter with a 50 microampere and a 1000 microampere range.

One man can operate the unit. It weighs only 50 pounds, so that it is easily transported. Input power is low. The tester may be supplied from any 120-volt 60-cycle source.

Fully Protected

The microammeter is protected against sudden surges and protected against continuous overloads by a neon bulb that fires and by-passes the measuring circuit when an overcurrent occurs. Output current is limited in case of insulation failure by series resistors. The circuit high voltage components are protected against accidental over-voltages by an adjustable gap which discharges the output capacitor through a resistor.

Economical

The L-M DC Insulation Tester costs only $375.00. It takes out the guesswork and assures more positive recloser maintenance. A few moments' time can prevent hours of additional apparatus replacement, and the timely replacement of a faulty piece of insulation may prevent serious damage or complete destruction of valuable apparatus.

Get Complete Information

Ask the L-M Field Engineer for the new bulletin on the L-M Insulation Tester—or get a demonstration. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

The L-M Insulation Tester is completely self-contained. Cover holds all leads, power cord, and instruction book. The whole unit weighs only 50 pounds.

155-R

LINE MATERIAL

Kyle Reclosers

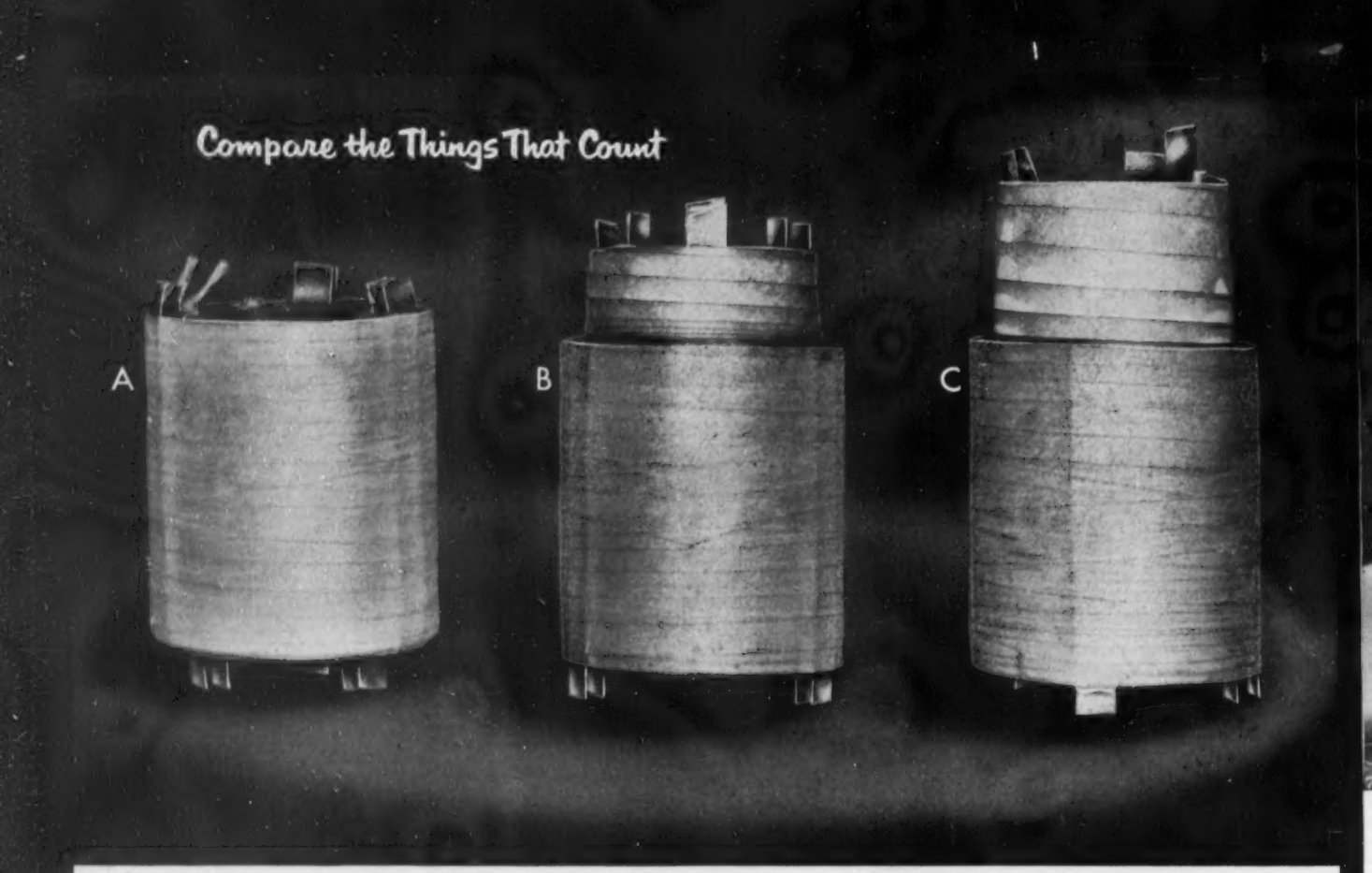


FIGURE 1: Results of the new shock test of varnish bonding strength. Coil A, impregnated with the best varnish, shows no separation. Coils B and C show too much separation, and the varnishes were rejected. For comparison, a coil whose insulation paper is brushed with shellac during winding will be torn almost completely apart, and an unimpregnated coil will be entirely separated.

FIGURE 2: Impregnated coil prepared for the shock test. Steel straps around the inner coil are fastened to the yoke at the top; straps around the outer coil are fastened to the bottom yoke. Coils will be violently jerked in opposite directions.

"Round-Wound" is a Line Material Company trademark

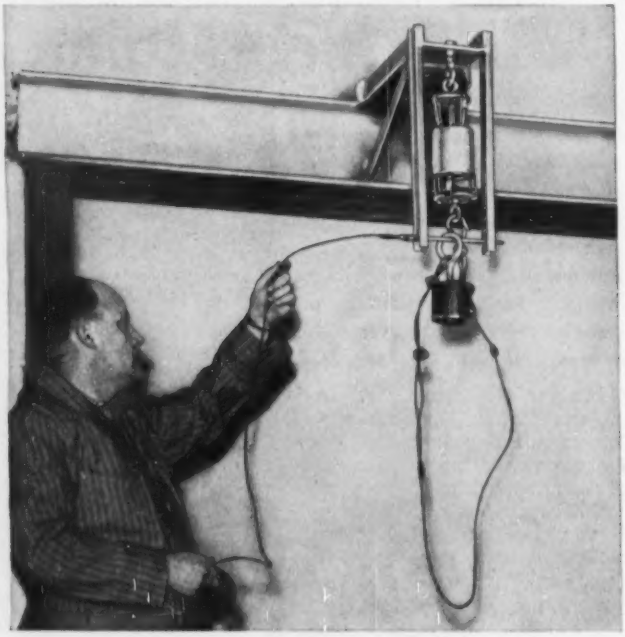


FIGURE 3: Shock test equipment. The top yoke is hung from a rigid support. A 10-pound weight attached to the bottom yoke by a steel cable is dropped 7 feet, resulting in an impact shock of 212 pound-feet per second. The amount of separation of the high voltage from the low voltage winding after one impact determines bonding strength of the varnish being tested.

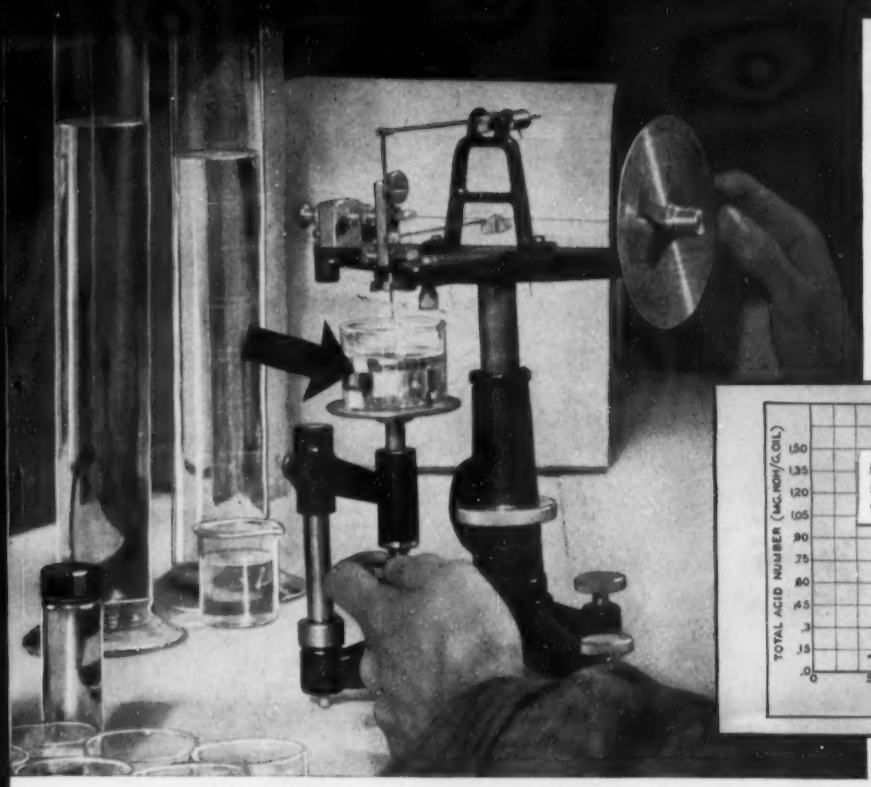
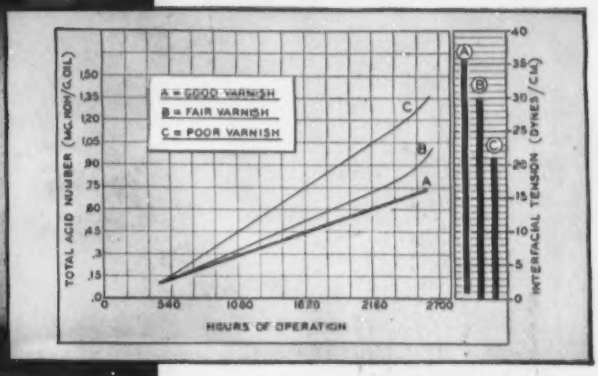


FIGURE 4: Interfacial tension tests of transformer oil (arrow), before and after cured varnish samples have been baked in the oil, are accurate predeterminations of the long-term resistance of the varnish to the oil.

FIGURE 5: Curves show long-term oil acid number for three different varnishes; bars show comparative short-term interfacial tension of the same varnishes.



L-M Develops New Varnish Tests To Assure Stronger Coils In Round-Wound Transformers

In addition to bonding strength, varnish requirements include low curing temperatures and freedom from contamination of or by the oil.

by **MARTIN I. ZWELLING**
Chief Laboratory Engineer
Transformer Division
Line Material Company

The primary, if not the single, reason for varnish impregnation of transformer coils is to resist short-circuit mechanical shocks. Under abnormal currents, windings tend to fly apart radially, and coils try to separate axially. In addition to strong blocking and clamping, good varnish impregnation is a substantial aid in resisting these forces.

But the problem is to get the right varnishes. Some varnishes will tend to dissolve in oil and thus lose their bonding strength. Others may appear not to dissolve but may actually contaminate the oil in long-term service and cause it to deteriorate more rapidly.

Curing must be complete, throughout the entire mass of the varnish and the coil. Some varnishes require curing temperatures so high that the life of the cellulose insulation is seriously reduced. Some varnishes simply do not possess the inherent bonding strength needed to resist short-circuit shock.

Recommended New Procedures

One drawback to selecting varnishes which meet all the requirements has been the lack of adequate tests for determination of varnish characteristics. Therefore we have developed new procedures to give us the necessary information.

One test (Fig. 4) provides a measure of the short-term resistance of varnish to transformer oil. Another measures the long-term resistance. Correlation between the two tests is very high. Compare the long-term rise in acids to short-term interfacial-tension test results in Fig. 5.

Bonding Strength Test

A new test was developed for varnish bonding strength (Figs. 1, 2, and 3). This test endeavors to pull sample coils apart by mechanical shock. An unimpregnated coil will be torn completely apart. Only the very best varnish completely resists separation.

Correlated With Service Conditions

Tests have been checked and closely correlated with actual service conditions, by comparing the condition of the oil and the resistance to short circuit of actual transformers impregnated with the various grades of varnish, with the laboratory tests of the same varnishes.

Benefits To Transformer Users

As a result of the program, we have been able to secure varnishes that have better resistance to oil, greater bonding strength, and lower curing temperatures so that there is less effect on cellulose insulation. Excellent characteristics of normal properties, such as dielectric strength, are also obtained.

All of these activities are part of a broad L-M engineering program that has been markedly successful in providing, in L-M Round-Wound transformers, the most desirable performance characteristics, with the added benefits of low operating costs and exceptionally long life.

Get The Whole Story On Round-Wound Transformers

Get the facts on the outstanding characteristics, the "Balanced Performance" of L-M Round-Wound Transformers. *Compare the things that count!* Ask the L-M Field Engineer for Bulletins and information; or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

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LM® LINE MATERIAL Transformers

Completely hook-stick operated. Fuse cartridge can be removed or replaced with standard head switch stick.

L-M's Type HXO Power Fuse Cutout Interrupts up to 20,000 Amperes

Double-Venting: replaceable fuse link button closes top of tube; on low-amperage faults, the tube vents at bottom only; on high faults, pressure releases button at top, giving double-venting. This insures successful interruptions on both low and high fault currents.

Rated at 200 amperes, with interrupting capacities as follows:

20,000 amps at 7.5 kv
15,000 amps at 15 kv
9,000 amps at 23 kv
5,000 amps at 34.5 kv
4,000 amps at 46 kv

These interrupting capacities apply for full range of fuse link sizes from 1 ampere through 200 amperes.

Replaceable Power Fuse Link

Field-replaceable E-rated power fuse links, similar in design and construction to those used in distribution cutouts. No cartridges to replace, no filler tubes to buy. Designed for positive corona-free operation at high currents and voltages. Ratings and performance meet NEMA Power Fuse Standards.

L-M Power Fuse Links cost only $2.60 each (smaller sizes $1.60) compared to other cutouts requiring complete cartridges at $10 or more. Sizes from 1 to 200 amperes.

Get Full Information on the HXO

Ask the L-M Field Engineer for details and bulletin, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

fuse cutouts

117

Wide Acceptance Shows Need For L-M Heavy Duty Cutouts

L-M's "PHD" (Porcelain Heavy Duty) Fuse Cutouts have met with wide acceptance all over the country. This shows the need that exists for a complete line of cutouts designed and built especially for service on high capacity distribution feeders.

5 kv

50 amperes
8000 amperes
interrupting capacity

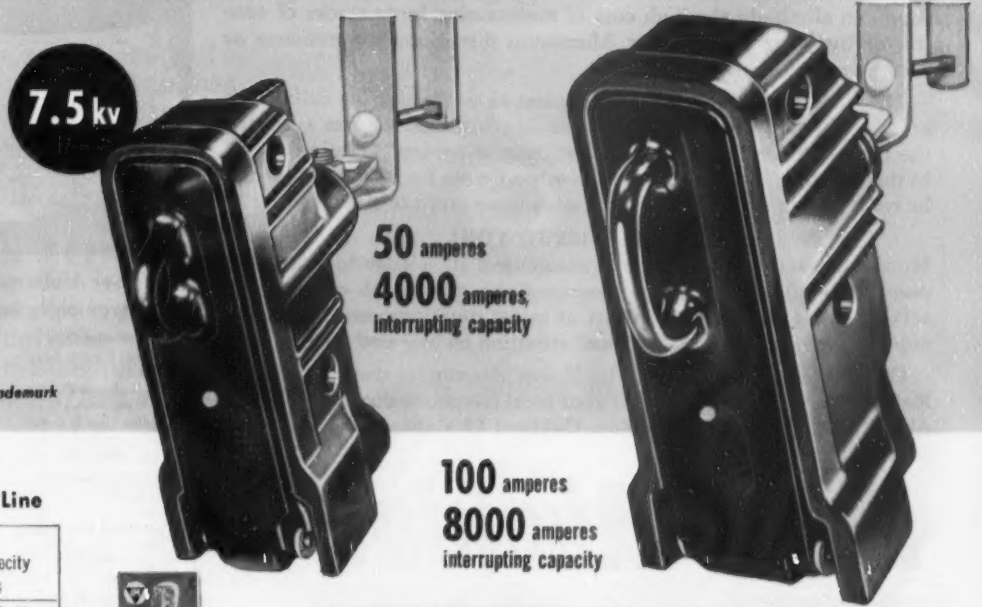
100 amperes
14,000 amperes
interrupting capacity

200 amperes
20,000 amperes
interrupting capacity

L-M's "PHD" Cutouts, introduced more than two years ago, comprised the first complete line of heavy duty cutouts with realistic and usable interrupting capacities. Extensive testing was conducted for two years before they were introduced. Special attention was paid to design details, such as cementing, contact alignment, and door and cartridge positioning, which govern successful cutout operation. These cutouts successfully clear both high and low amperage faults—safely, without danger of exploding porcelain—and assure safety for personnel and equipment, and continuity of service.

"PHD" is a Line Material Company Trademark

7.5 kv



50 amperes
4000 amperes
interrupting capacity

100 amperes
8000 amperes
interrupting capacity

Here's Complete "PHD" Line

5 kv Rating	Interrupting Capacity rms amperes	
	2.5 kv*	5 kv**
50 amps.	8,000	5,000
100 amps.	14,000	10,000
200 amps.	20,000	15,000
7.5 kv	Interrupting Capacity	
50 amps.	4,000 amperes	
100 amps.	8,000 amperes	

*or line-to-neutral on 4160 or 4330 volts Gr.Y. **or line-to-neutral on 8330 volts Gr.Y.

150

For information ask the L-M Field Engineer for Bulletins, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

fuse cutouts and fuse links

WHY SHOULD YOU PAY FOR THIS?

You can eliminate the high cost of maintaining large stocks of conductor by using your Kaiser Aluminum distributor's warehouse *as your own inventory.*

He can give you dependable delivery *as your schedule calls for it* on a complete line of Kaiser Aluminum conductor. He has available the largest range of sizes and construction of covered aluminum wire in the industry. This means your overhead costs for storage space can be reduced to a minimum, which means more profit for you.

EXTRA SERVICE TO YOU!

He also offers his experience and specialized knowledge to help solve your individual problems, makes available top-notch engineering services, helps you keep abreast of latest developments and techniques, gives you friendly, personal attention on any size order.

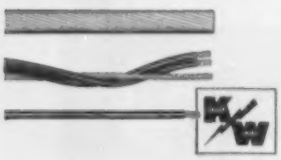
Get in touch with your nearby Kaiser Aluminum distributor *now.* Refer to the list at the right and your local telephone directory. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

Kaiser Aluminum Distributors conveniently located to serve you:

Line Material Co.
General Electric Supply Co.
Westinghouse Electric Supply Co.
Capital Electric Supply
Central Electric Supply Co., Inc.
Champion, Inc.
City Electric Distributors, Inc.
Crescent Electric Supply Co.
Dauphin Electrical Supplies
Dutton-Lainson Co.
Electrical & Mechanical Supply Corp.
Eoff Electric Co.
Evans Electrical Supply, Inc.
Florida Electric Supply, Inc.
George H. Wahn Co.
Hampden Electric Supply Co.
Hunzicker Brothers
Interstate Electric Co. of Shreveport, Inc.
Maydwell & Hartzell, Inc.
Nelson Electric Supply Co.
Price Electric Co.
Russell Belden Electric Co.
S. M. Supply Co., Inc.
Southern Minnesota Supply Co.
Stuart C. Irby Co.
Stubbs Electric Co.
Tafel Electric & Supply Co.
The Kersmeyer Co.
Virginian Electric, Inc.
Waltrip Electric Co.

Kaiser Aluminum

setting the pace—
in growth, quality and service



Solid and Stranded Neoprene and Polyethylene Covered Conductor
Self-Supporting Triplex Cable • ACSR • All Aluminum Conductor

new

EMERGENCY CLOSING DEVICE

portable unit provides full-speed closing of air magnetic breakers

Here's the first safe, reliable method of emergency closing a standard air magnetic breaker onto an energized line where no source of control power is available.

The *Pneu-Draulic* closing device weighs only 40 pounds and can be attached in less than 30 seconds. Its small size (8 x 14 x 10 inches) permits storing near breakers for instant availability. Only one device is needed for all Allis-Chalmers breakers of one type.

Basically, the *Pneu-Draulic* closing device is similar to that in the *Pneu-Draulic* operator for high capacity breakers. Only two moving parts are used to close breaker.

For more information, call your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wis.

A-4298

WHY USE THIS CLOSER?

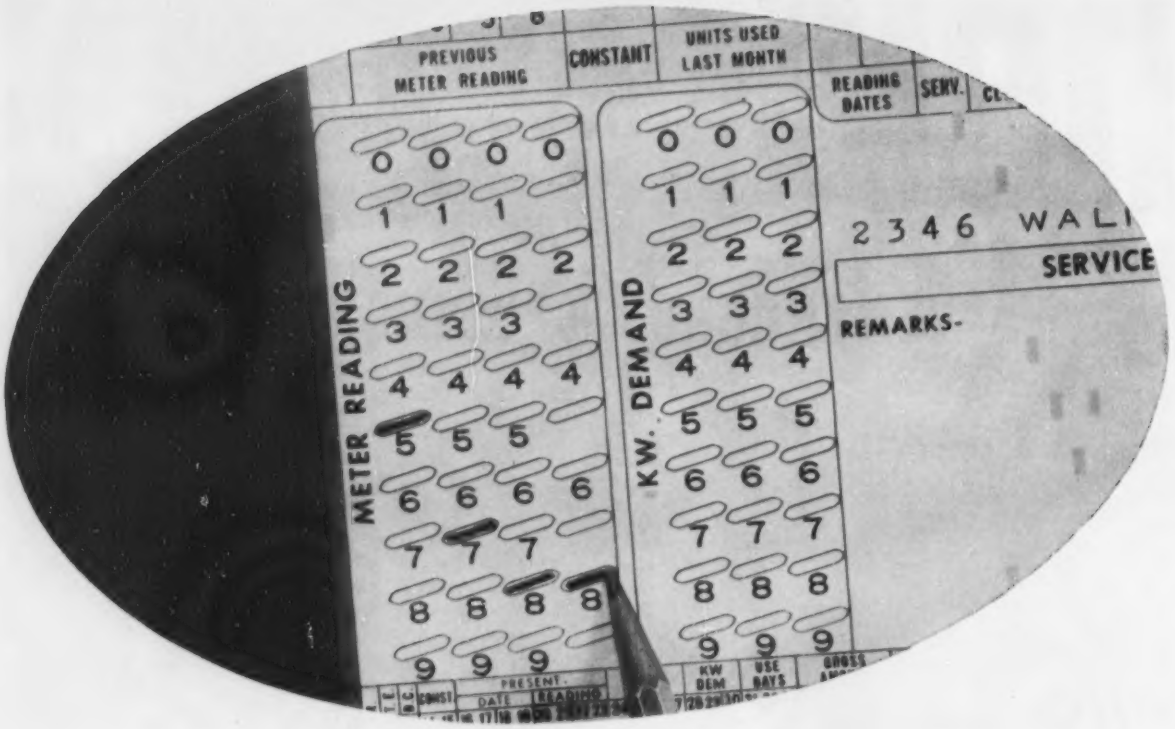
Fundamentally — Safety! An air breaker closing on an energized line must be closed at normal speed. Using the usual manual emergency handle this cannot be done. This device affords the necessary speed.

WHEN DO YOU NEED THIS CLOSER?

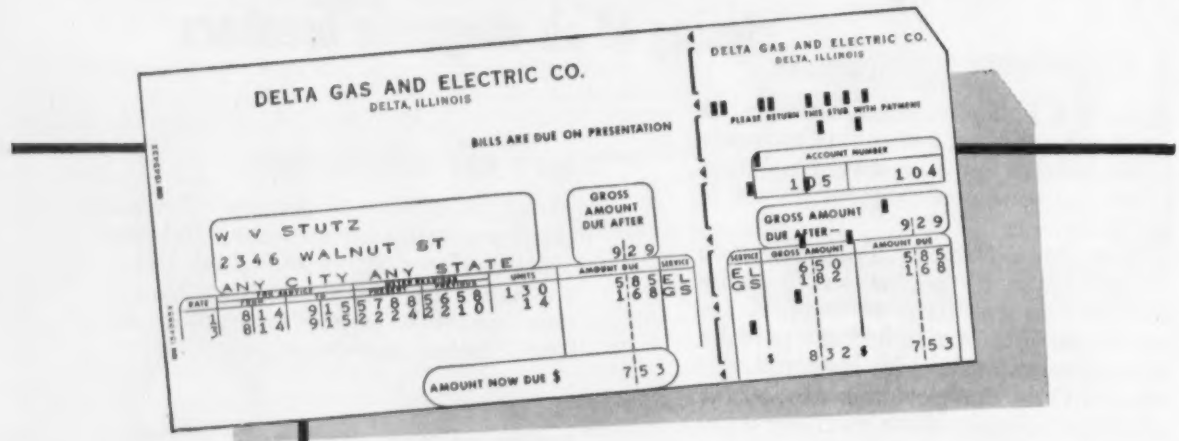
Whenever any trouble occurs in the source of control power to the breaker. For example: failure of fuses, solenoid, rectifier, relays, wiring, control switch, or control power transformer.

Pneu-Draulic is an Allis-Chalmers trademark.

ALLIS-CHALMERS



THESE MARKS CUT COSTS



Pencil marks like these on an IBM METER READING CARD can send your costs dramatically downward.

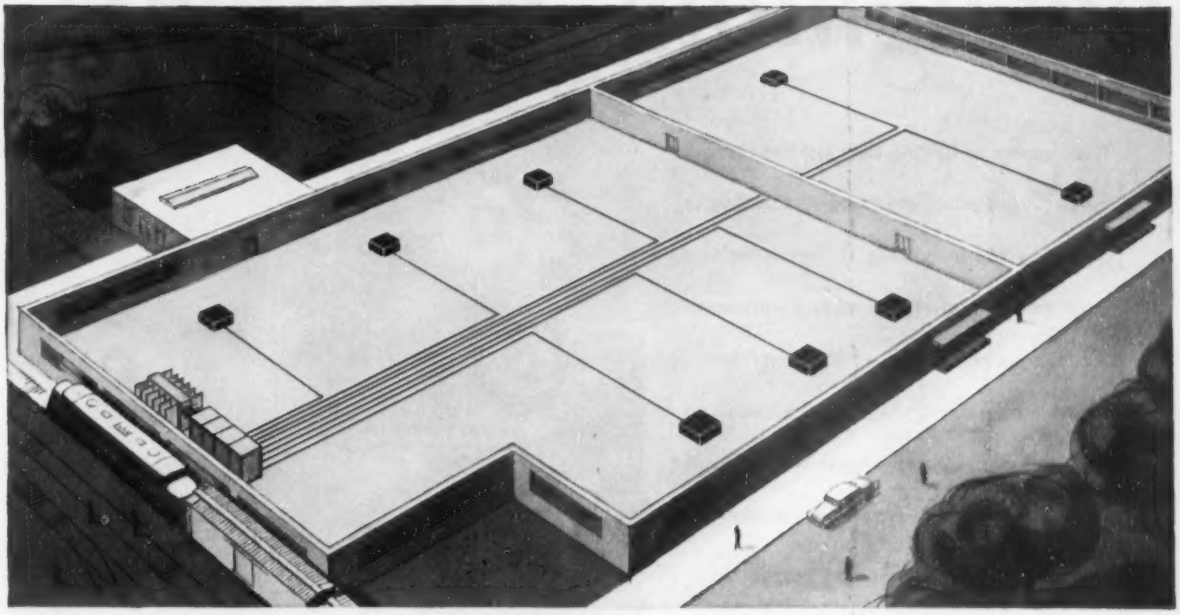
There is no other writing to do before an IBM electronic machine automatically punches an IBM card with holes corresponding to the marks. This means no errors in transcription.

From the punched cards, bills as well as statistical, analytical, and accounting reports are machine-prepared. Your accounting department saves time; reports and analyses are ready when they are needed most; bills are out faster—receipts in sooner. Result—reduced costs!

IBM

INTERNATIONAL BUSINESS MACHINES
590 Madison Avenue, New York 22, N. Y.

How G-E job-planned power systems can help maintain plant efficiency



WHEN INCREASING LOADS CALL FOR A NEW POWER DISTRIBUTION SYSTEM — G-E WIRE AND CABLE WILL GIVE IT THE VERSATILITY NEEDED FOR FUTURE EXPANSION.

The continuing development of new electrical equipment, processes, and materials handling methods doubles the use of electricity approximately every ten years — according to the findings of qualified authorities. This means that you may need a new or expanded distribution system to handle these greater loads efficiently — because the unstable voltages that result from overloads increase distribution and equipment maintenance costs, and result in outages, faulty operation of equipment, and interrupted production.

A General Electric job-planned cable system is designed and coordinated to maintain plant efficiency by accommodating growing and changing load requirements. And G-E cables will keep your installation costs to a minimum, too.

Here are some examples:

85 C Super Coronol* cable provides overload capacity

G-E Super Coronol cable's normal rating (85 C up to 8000 volts) and its emergency rating (up to 115 C depending on voltage) give you reserve capacity for handling growing loads. This cable, used for lead-ins and cable feeders, can be buried directly in the ground or installed in conduit or ducts.

G-E interlocked armor cable system provides for changes in plant layout

G-E V-c interlocked armor cable primary or secondary feeder systems can be installed quickly, and can easily be expanded or relocated to accommodate changes in load patterns — because each circuit is a separate, flexible cable that needs no conduit. Planned G-E cable systems are of growing importance to an industrial plant, and can have a major effect on the plant's efficiency. So, when you have to handle increasing loads, let your G-E wire and cable specialist help you with the planning. For more information on G-E cable systems, write Section W127-327, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*Registered Trade-mark General Electric Company

You can put your confidence in—

GENERAL ELECTRIC

to you the lighting "missionary"

There's more to lighting than just fixtures and lamps . . . just metal, glass and wire. Selling or specifying better lighting is human welfare work: greater comfort for tired eyes—preservation of eyesight—better working conditions—more pleasant surroundings. It also means: no more torturing eyestrain—less fatigue—less nervous tension—better postures—a healthier disposition.

As a Lighting Man, you are fulfilling an important mission. You are contributing to a happier life for untold millions.

BE PROUD TO BE A LIGHTING MAN!

Copies of this ad suitable for framing—without our trademark—mailed free upon request on your letterhead.

It's not always the glamour—
it's the eye-comfort that counts

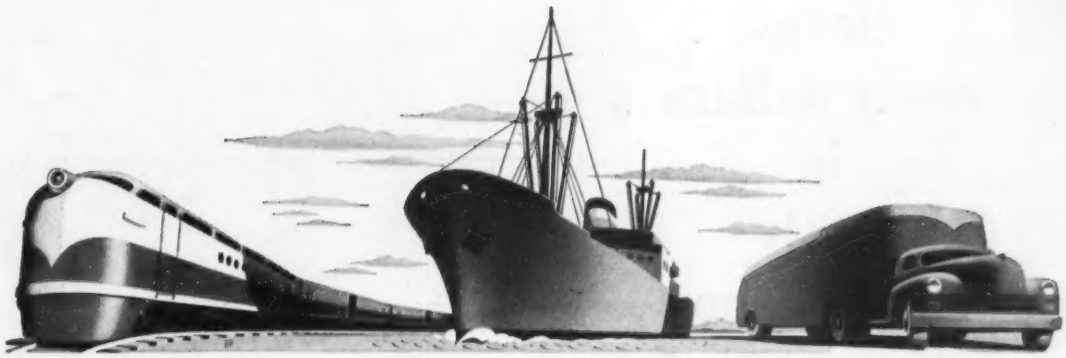
Guth LIGHTING

THE EDWIN F. GUTH COMPANY • ST. LOUIS 3, MO.

Leaders in Lighting Since 1902

GENERAL CABLE

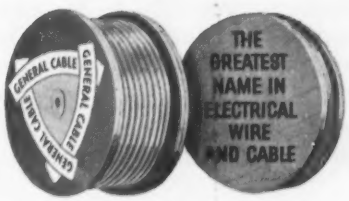
THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE



Everything being equal

IT'S THE SERVICE THAT COUNTS!

It is the simple objective of General Cable *service* to make our products both easy and pleasant for you to buy. We do it with more than 650 courteous, well-informed distributors. We do it with over 300 stock distribution points and 12 warehouses. We do it with 27 sales offices, plus 14 helpful resident salesmen. We do it with 6 strategically located manufacturing plants. This is a combination unmatched in the industry. We invite you to try it!

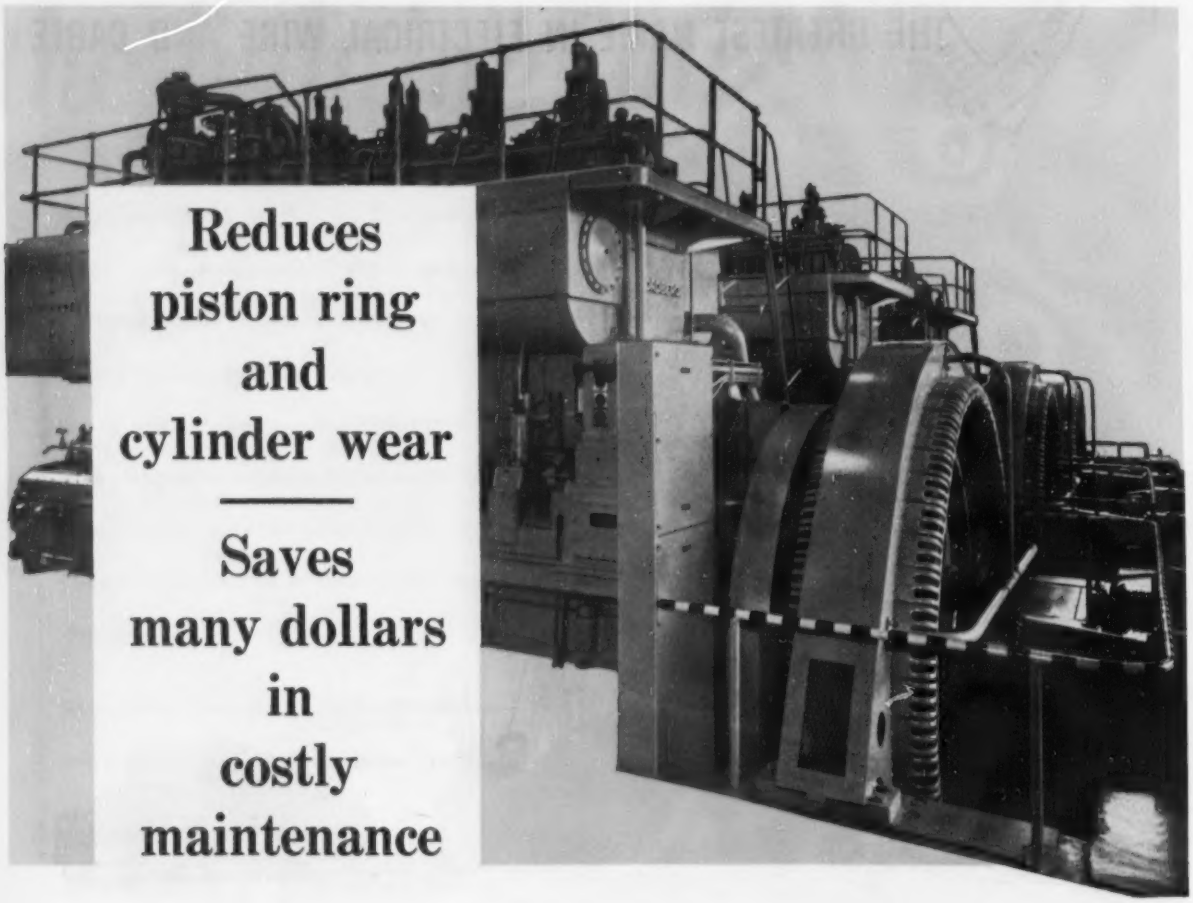


BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION 420 Lexington Avenue, New York 17, New York

Sales Offices: Atlanta • Buffalo • Cambridge (Mass.) • Chicago • Cleveland • Dallas • Detroit • Greensboro (N. C.) • Houston Indianapolis • Kansas City • Los Angeles • Milwaukee • Minneapolis • New York • Newark (N. J.) • Philadelphia • Pittsburgh • Portland (Ore.) • Rome, N.Y. • Rossmoyne, O. (Cincinnati area) • St. Louis • San Francisco • Seattle • Syracuse • Tulsa • Washington, D. C.

Shell Rotella Oil



Reduces piston ring and cylinder wear

Saves many dollars in costly maintenance

These dual-fuel engines in the Municipal Power Plant at Houma, Louisiana, supply dependable, low-cost electric power to the entire city. Shell Rotella Oil is the cylinder lubricant.

Here's just one of the many diesel power plants that depend on SHELL ROTELLA OIL for reduced wear of engine parts . . . lower maintenance cost.

The anti-corrosive action in Shell Rotella Oil combats the major cause of engine wear . . . cylinder and piston ring wear caused by acid action from the by-products of incomplete combustion and condensation.

Tougher lubricating film in Shell Rotella Oil gives cylinders and rings greater protection . . . minimizes wear. Its effective detergent-dispersant action prevents harmful deposits.

Write for technical information. See for yourself how Shell Rotella Oil can help reduce your engine maintenance costs.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
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SHELL®

3E SHIPS ISOLATORS 10 DAYS FROM ORDER

Our large inventory and co-ordinated production makes fast delivery possible.

90% of These Popular Straight-line Disconnects Now Available in 10 Days

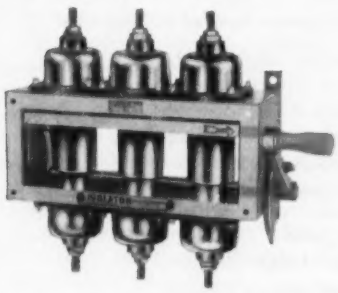
Prompt shipment, fast installation, less space. If you want these features in the switchgear you specify, take a good look at the ISOLATOR.

There are no shortcuts here . . . the ISOLATOR is solidly built, first class switchgear. While we offer 276 different models, 90% of all ISOLATORS sold are the 13 models in most common use. By carefully co-ordinating inventory with production we fill these orders in 10 days.

Prompt shipping service is important. 3E gets equipment to you quickly and safely.

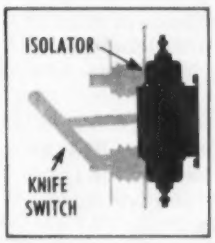
How ISOLATORS Disconnect Primary Power in 1/3 the Usual Space

The feature that makes the ISOLATOR different from all other switches is its straight-line telescoping action. *The ISOLATOR takes no more space when open than when closed.*



3 P.S.T. 400 Ampere 5000 Volt ISOLATOR

When the ISOLATOR moves from closed to open position its current carrying parts move in a straight line and telescope as contact is made. The parts are enclosed in insulated bushings which also telescope, shielding live parts and eliminating flash barriers.



If you can cut down the amount of space required by a switching cubicle you save material and floor space. Both are costly. Here the ISOLATOR comes into its own as the ideal disconnect. It needs only one-third the space required by knife switch of equal rating.

Since the ISOLATOR is more compact than an equally rated knife blade type of switch, it weighs less. Consequently, it can be mounted and installed in much less time. Furthermore, all elements, including poles, are mounted and aligned on a rigid frame in our factory. You will find them faster and easier to install.

The ISOLATOR is safer . . . when it is in open position the *contacts* are far apart but the opening between the bushings, while visibly open, is narrow enough to lessen the chance of accidental contact. The exposed studs at top and bottom are arranged for easy taping. Your men working in ISOLATOR equipped cubicles are safe from live part hazards.

SEND THIS COUPON FOR FULL DETAILS ABOUT THE ISOLATOR

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS
THREE

Electrical Engineers Equipment Co. Dept C, Melrose Park, Ill.

☐ Please send ISOLATOR literature.
☐ Please have your representative call.

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Title_____
Company_____
Address_____
City_____ Zone____ State_____

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You Can Rely on Motorola® Microwave for NON-STOP PERFORMANCE

Motorola Systems Are In and Working—24 Hours a Day—For Power Companies Across the Nation.

Utilities and power companies everywhere have turned to Motorola Microwave for communications that shrug off bad weather and rough terrain. Thousands of miles of multi-channel Motorola Microwave—with hundreds of operating stations—delivering non-stop, 'round-the-clock performance year in and year out.

Motorola Microwave provides simultaneous transmission of numerous (1) voice, (2) telemetering, (3) teleprinting and (4) industrial control signals over one radio frequency carrier. Microwave assures positive control of widely separated, remote system facilities. Get the facts. ***Motorola Microwave can cut communications costs, save man-hours and speed operations for you!***

Motorola Systems Are In and Working for These Companies

Partial list of systems installed and operating.

Arkansas Power and Light Company*
Bonneville Power Administration
Brazos River Electric Transmission Cooperative
Central Illinois Public Service Company
Cleveland Electric Illuminating Company*
Dayton Power and Light Company
Gulf States Utilities Company*
Illinois Power Company
Louisiana Power and Light Company*
Mississippi Power and Light Company*
New Orleans Public Service, Inc.*
Northern Indiana Public Service Company*
Ohio Power Company*
Pacific Power and Light Company
San Antonio Public Service Board
Southern California Edison Company
Texas Electric Company

*Under Construction

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Job-Proven Microwave . . . by the Leaders of the 2-way Radio Industry

For full details—write Dept. 2286-EW

Consider the basic advantage of ultrasonic testing

. . . when critical piping is the order!

Experienced power engineers have for years been aware that alloy power piping is subject to defects which can not be revealed by conventional inspection methods. But to radiograph whole lengths of piping would be prohibitively expensive.

As a result there were occasional failures. Subsequent investigations showed that internal cracks rather than improperly welded joints were usually the cause of rupture. Such flaws would not be detected by any normal inspection methods.

To meet this problem, Kellogg, in collaboration with a large user of this class of material made investigations of inexpensive, non-destructive testing techniques which would reveal indications of hidden flaws. This program resulted in the introduction of commercial ultrasonic testing of alloy piping.

Today Kellogg uses the method extensively on high-temperature, high-pressure power piping before it is fabricated in the shops. As a successful and low cost method of putting a finger on possible injurious defects with startling accuracy, its usefulness is well documented. In view of the steadily increasing temperatures and pressures demanded by the economics of modern power generation, the value of this development is obvious.

This approach to the problems of fabricating the highest quality power piping—the willingness to explore new techniques, develop new methods—is basic to Kellogg's operation. Many power station designers and utility companies also say it's the basic reason why they repeatedly specify *"critical piping by Kellogg"*.

These leading companies are among the many major producers of power who use M. W. KELLOGG POWER PIPING . . .

- American Gas & Electric Service Corp.
- Boston Edison Co.
- Central Hudson Gas & Electric Co.
- Chaudronneries A. F. Smulders (Belgium)
- Compania Argentina De Electricidad
- Compania De Fuerza Del Sureoste De Mexico S.A.
- Consolidated Edison Co. of N. Y.

OTHER FABRICATED PRODUCTS include: Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchangers . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings

For further information, details of methods, etc. contact

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

225 Broadway, N. Y. 7, N. Y.

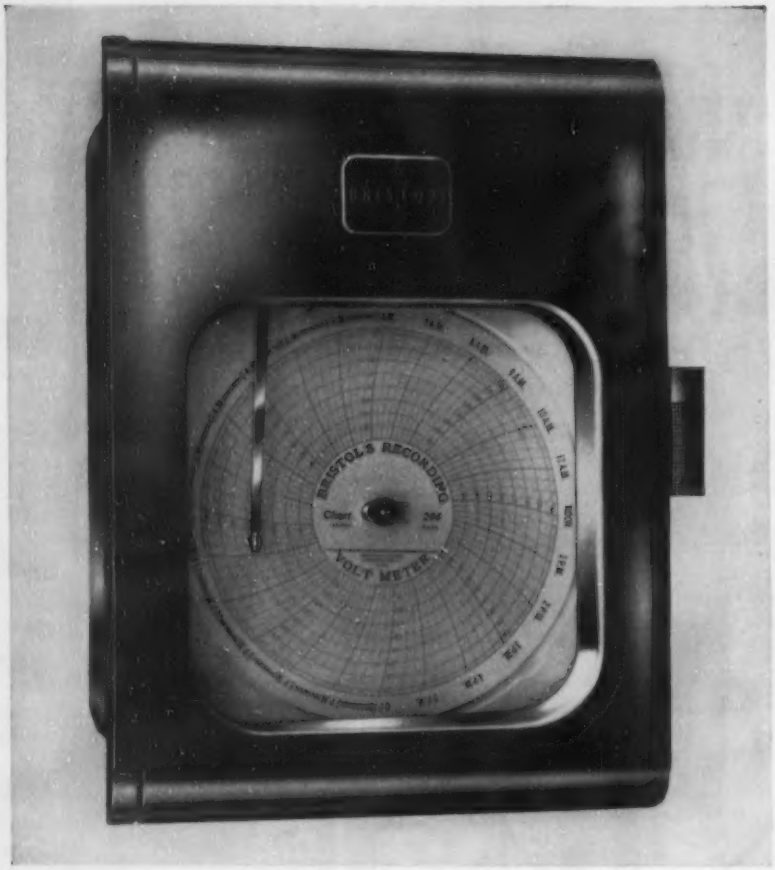
also Jersey City, Buffalo, Chicago, Los Angeles, Tulsa, Houston

In Canada—Toronto and Edmonton

In Europe—London and Paris

M KELLOGG W

Subsidiary of PULLMAN Incorporated



NEW, EASY-TO-READ BRISTOL RECORDING VOLTMETERS AND AMMETERS are available for permanent mounting or for use as portable instruments.

You'll get greater accuracy, greater dependability with Bristol recording voltmeters and ammeters

Here's why:

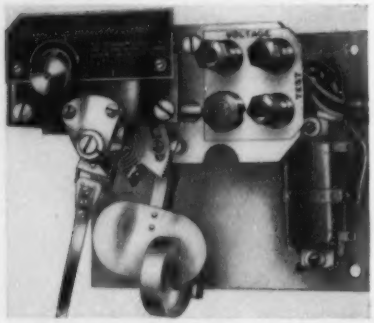
1. Low electrical burden — the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensation.
4. Shock-proof measuring mechanism mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes — up to full scale value.

These modern units are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

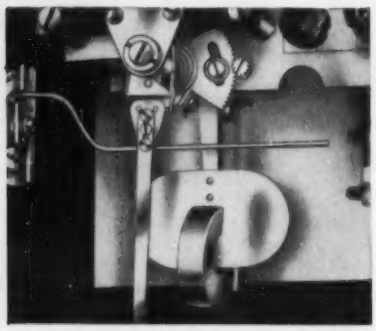
Get the whole story on these precision instruments. Write today for free 28-page Bulletin E1111 to THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn.

Many ranges carried in stock for immediate delivery

LOOK AT THESE FEATURES!



NEW MEASURING MECHANISM — High-quality, accurate, dependable Bristol moving-iron mechanism used in all models.



MAGNETIC DAMPING — all models equipped with aluminum vane and alnico magnet damper which gives maximum speed of response possible with minimum overshoot.

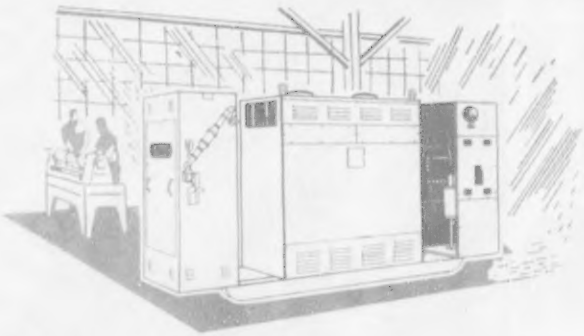
PEN MOUNTING — Pen-arm mounting shaft firmly supported at both ends — eliminates trouble from back-lash and lost motion. Pen arm is readily removed and replaced.

BRISTOL

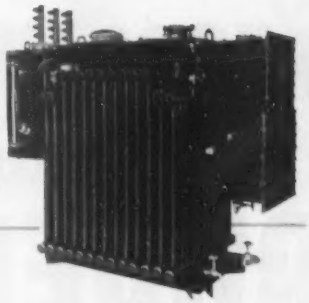
POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

custom-built transformers

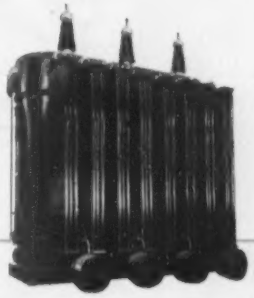


Askarel filled subway type network transformer, 500 KVA, 12480 to 216Y/125 volts, 3-phase, 60-cycle, complete with high voltage disconnect and grounding switch, low voltage network protector, and electrical interlocks.



Dry type air-cooled, load center transformer, 225 KVA, 3-phase, 60-cycle, 2400 to 120/208Y volts. Gang operated oil-fused cutouts are included with operating handle which is accessible through door in end of cabinet.

Power transformer, 10,000/12,500 KVA, 3-phase, 50-cycle, voltage 69,000Y to 13,200Y, with tertiary winding of 3500 KVA, air blast equipment for supplemental rating, low voltage terminal chamber and wheels.



When custom design is a factor . . .

TRANSFORMERS are the only product The Standard Transformer Company builds . . . the most important part of the load center. You thus have complete freedom in your choice of accessory equipment.

Specify the type and make of switchgear you prefer . . . STANDARD will quickly produce a complete, well-integrated unit, exactly designed to the proper dimensions and arranged according to your requirements.

As STANDARD has specialized in transformer design and application for more than 30 years, unusual assemblies are usual with us. You write your own ticket.

Whether unit installations are required for indoor, outdoor or underground, STANDARD will meet your most exacting requirements and include accessory equipment made by the supplier you prefer.

Write today for specific information.

Everything points to . .

WRITE FOR BULLETIN CL-50

See and read about actual transformer installation on the job around the world . . . evidence that your confidence in STANDARD is well placed.

Standard

THE STANDARD TRANSFORMER COMPANY

Trade Mark

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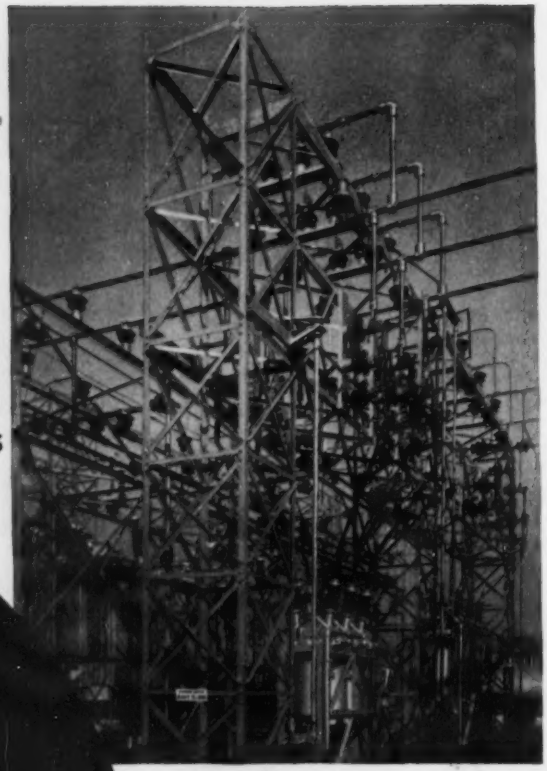
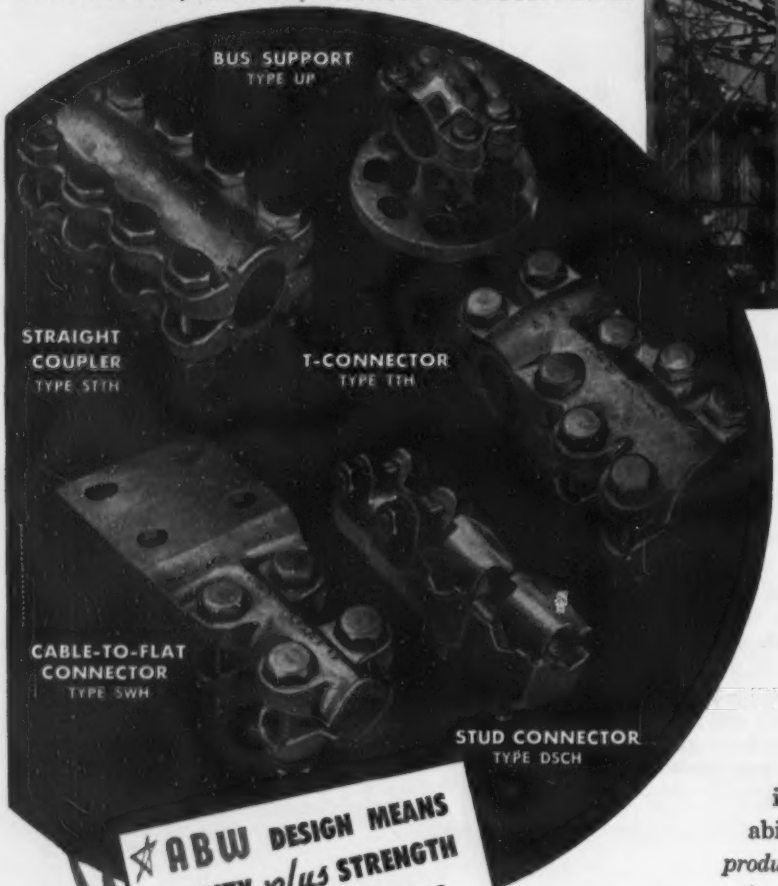
REPRESENTATIVES IN PRINCIPAL CITIES

Your Source of Complete RESPONSIBILITY When you specify ANDERSON

CONNECTORS, CLAMPS, FITTINGS & ACCESSORIES





☆ ABW DESIGN MEANS QUALITY *plus* STRENGTH in the RIGHT PLACES

Consult one of our nearest 20 representatives or contact our main office.

for your SUBSTATIONS

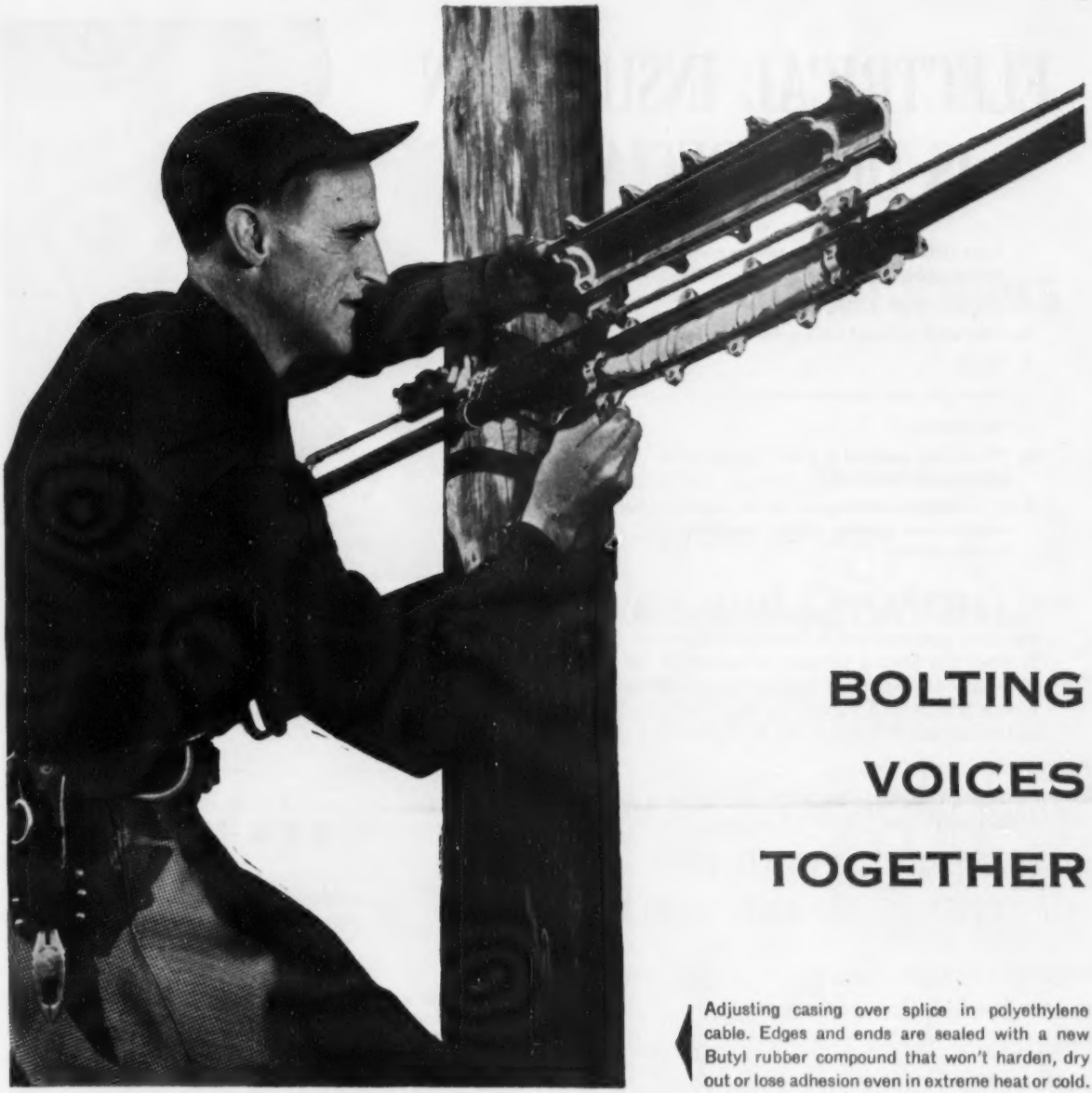
Anderson Products have been designed, engineered and manufactured to a "formula" laid down by *the most exacting service conditions*. Each connector, clamp, fitting or accessory is *guaranteed* to withstand extreme short circuit currents and overload conditions far in excess of rated capacities. This extra measure of dependability, *in the broadest line of electrical products offered by any one manufacturer*, is your assurance of safety, efficiency and longevity of service.

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES for SUBSTATION • TRANSMISSION • DISTRIBUTION SYSTEMS *for over a Quarter Century*

ABW

ANDERSON BRASS WORKS, INC.

P. O DRAWER 2151 • BIRMINGHAM 1, ALABAMA



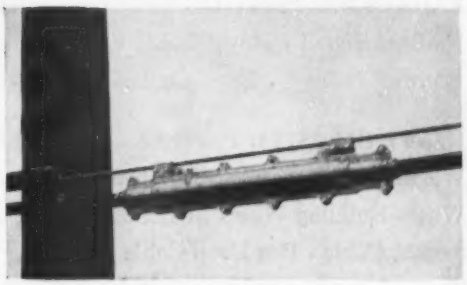
BOLTING VOICES TOGETHER

Adjusting casing over splice in polyethylene cable. Edges and ends are sealed with a new Butyl rubber compound that won't harden, dry out or lose adhesion even in extreme heat or cold.

More than ever, light, flexible polyethylene sheathed cable developed by Bell Telephone Laboratories is providing speedy answers to the demand for more telephone service.

But at thousands of splices, the sheath must be thoroughly sealed against moisture. Laboratories engineers developed a protective casing which is quickly and simply bolted in place. The edges and ends of the casing are *permanently* sealed with a new compound developed by Laboratories rubber chemists.

Now, economical polyethylene cable can be installed much faster and at lower cost. Here is another example of how Bell Laboratories continually finds ways to keep telephone service high in quality, while the cost stays low.



CLOSED CASING IN PLACE

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

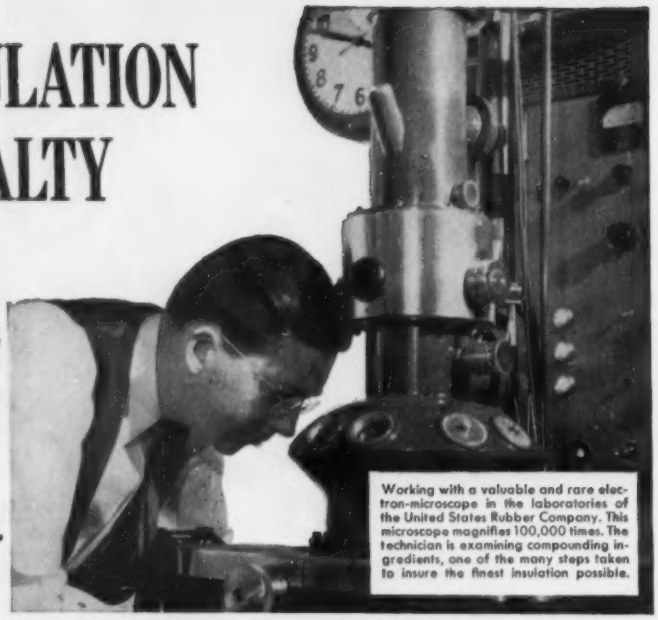
A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.



Working with a valuable and rare electron-microscope in the laboratories of the United States Rubber Company. This microscope magnifies 100,000 times. The technician is examining compounding ingredients, one of the many steps taken to insure the finest insulation possible.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables • Street Lighting • Royal Cords • Network Cables • Utility Control • Pole & Bracket Cable • Service Entrance • Weatherproof • Zip Cord Pole Fixture Cable • Sup. Control

RAILROADS: Power Cables • Communications • Railway Signal • Royal Cords • Welding Cable • Railway Utility • Sup. Control • Weatherproof

HEAVY INDUSTRY: Power Cable • Royal Cords • Welding Cables • Control Cables • Machine Tool Wire • Building Wire • Switchboard Wire • Thermostat Cable • Bus Drop Cable

ONE OF MANY SUPERIOR "U. S." WIRE AND CABLE PRODUCTS

USKORONA-NEOPRENE POWER CABLES

Ozone-resistant for high-voltage applications in wet or dry locations.

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 75 C. They will not crack after 3 hours in air containing .015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalis and corrosive chemicals. Uskorona-Neoprene cable also eliminates electrolysis. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Uskarana			Neoprene Jacket	
	Unaged	After 96 Hrs. O.B.	After 7 Day Geer Oven	Unaged	After 96 Hrs. O.B.
Tensile Lbs./Sq. In.	500	450	450	1800	1600
Elongation Per Cent	250	200	200	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

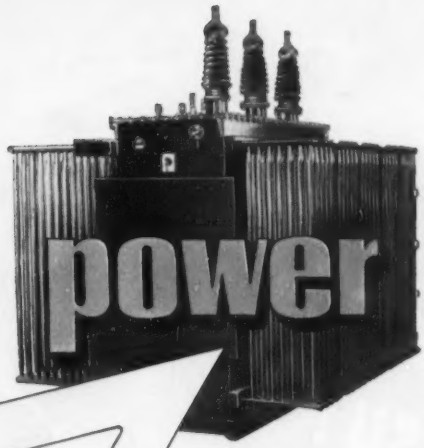
Dielectric Constant and Power Factor of the insulation after immersion in water at 50 C.: Dielectric Constant, one day is 4.5; per cent gain, 1 to 14 days is 5.0; per cent gain, 7 to 14 days is 2.0; Power Factor, per cent, one day is 3.0; Stability Factor 40-80 volts/mil two weeks, per cent is .5.

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

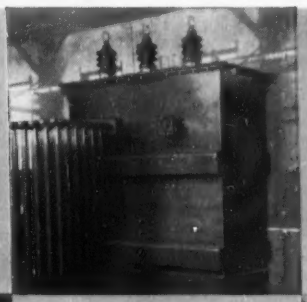
Uptegraff power Transformers



Long Life and Low Maintenance assured by important features of ***Design and Construction***

RUGGED

Special tank bracing withstands pressures of ±10 psi for ratings of 44 KV and less, and ±15 psi for higher ratings. Radiators are sturdy, yet accessible for cleaning and painting.

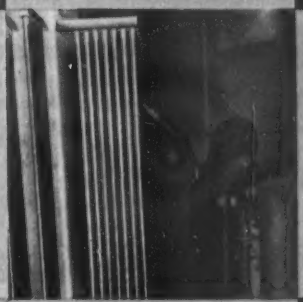


TIGHT

To eliminate leaks in sealed joints, a modern supersensitive electronic leak detector is used. It will find leaks as small as one ounce of air per year!

UNDERCOATED

The under surfaces of all Uptegraff Power Transformers are treated with a heavy coating that protects inaccessible areas against corrosion.

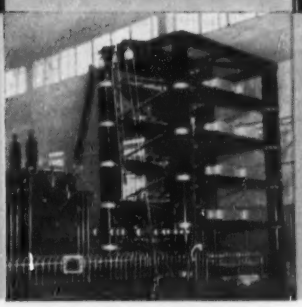


SHOT BLASTED

Tanks are thoroughly cleaned by shot blasting to prepare surface before protective paint coats are applied.

TESTED

Every Uptegraff Power Transformer is thoroughly tested before shipment. Modern test equipment includes a 1.5-million volt surge generator. We are fully qualified and equipped to make all NEMA, AIEE, ASA and other tests up to 10,000 KVA.

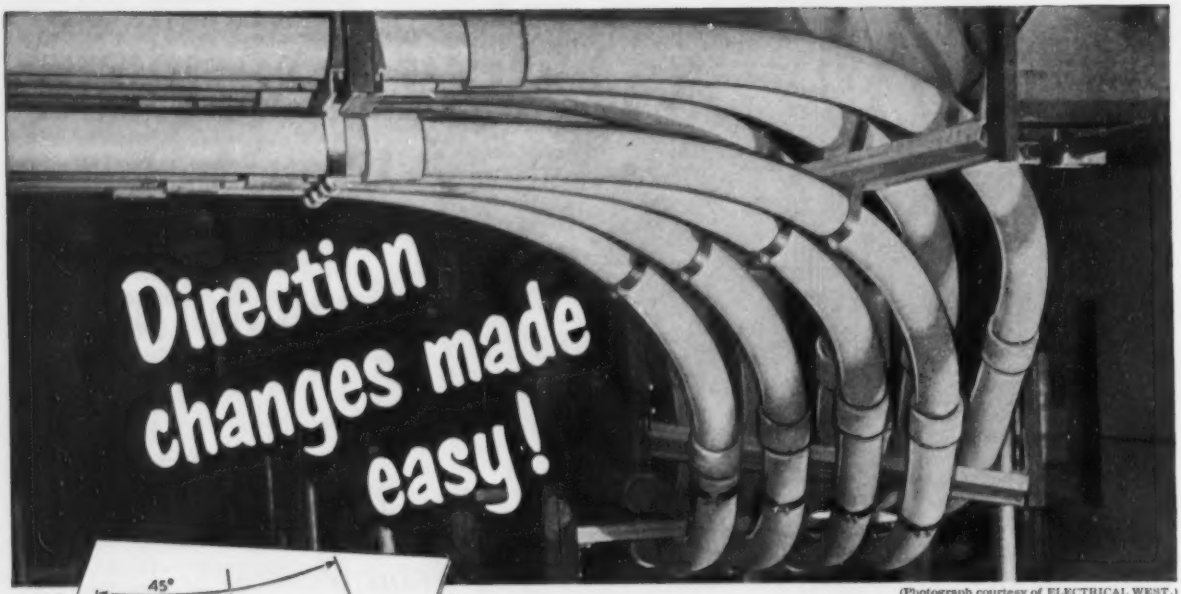


ALL SIZES

Made in sizes to 10,000 KVA, 115 KV for indoor or outdoor service. Oil or askarel filled. Uptegraff transformers meet the standards of ASA, NEMA and AIEE, and are *fully guaranteed.*

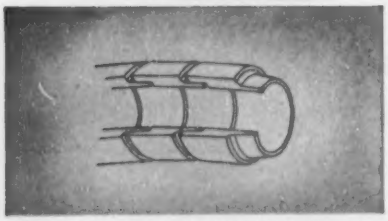
R. E. Uptegraff Manufacturing Co.

Scottdale, Pa.



(Photograph courtesy of ELECTRICAL WEST.)

. . . with standard fittings for TRANSITE *asbestos-cement* DUCTS



5° bend segment sketched in detail. It consists of a straight section of Transite stock with a male taper on one end and a female taper on the other . . . each machined at an angle of 2½° to the center axis. Segments can thus be used single, or combined to form bend sections whose curvature is any multiple of 5°.

Photograph showing use of bend segments and curved segments with Transite Ducts.

When you use Transite Ducts, you have available a wide variety of standard fittings, made of the same asbestos-cement material as the ducts themselves. These fittings save time and expense because they provide maximum flexibility in laying out or constructing a duct system. They facilitate clearing unexpected obstructions or accommodating revisions in the original layout.

For instance, the new Transite 5° Bend Segments (shown at left) can be used alone to form simple and complex curvatures of any multiple of 5°. Used with other standard Transite curved fittings, they form curvatures of odd degrees. Thus, they enable you to simplify cross-overs and transformations . . . to clear obstructions . . . to form unusual or special bend or offset sections. They eliminate the need for purchasing special radii bends or sweeps. The other standard Transite fittings that facilitate directional changes are the offset bends, standard 45° and 90° bends, sweeps, curved segments, laterals, tees, elbows and deflection couplings.

For complete information write for new brochure EL-45-A, "Fittings and Dimensions of Transite Ducts." Contains all dimensional data required by the designer. Also available, "Transite Duct Underground Installation Sheet," EL-43-A. Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto, Ontario.

5 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. **Corrosion-Resistant.** Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.
2. **Permanently Smooth Bore.** Transite makes long cable pulls easy, under any conditions. Danger of damage to cables is also minimized.
3. **Incombustible.** Transite will not burn or contribute to formation of smoke, gases, fumes. It confines burnouts, will not soften under heat.
4. **Higher Thermal Conductivity.** Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.
5. **Easy to Install.** Transite Ducts are light weight, easy to handle. Joints are quickly made. Long 10-foot lengths reduce number of joints in line.

Johns-Manville TRANSITE® DUCTS

JOHNS-MANVILLE JM PRODUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

PROTECT TRANSFORMERS *with*

R&IE

15 CYCLE *HIGH SPEED* GROUNDING SWITCH

Hi-Speed Grounding Switch shown mounted with a 161 Kv Switch.

Protect transformers by using QUICK-ACTING grounding switches to supply positive relaying and OCB operation before incipient faults cause extensive damage.

Example: In the absence of high speed OCB's, the automatic Hi-Speed grounding switch causes tripping of supply OCB's in case of a transformer fault.

Check the facts...

1. **Closing time—30 cycles or less.**
2. **Strong aluminum alloy blades minimize problems of inertia.**
3. **Blade and insulator shock absorbed by com-induced friction produced in extended, full floating Hi-Pressure contact jaw.**
4. **Blade opening effort minimized through release of contact pressure upon withdrawal.**

R&IE SWITCHING EQUIPMENT

DIVISION I-T-E CIRCUIT BREAKER CO.—GREENSBURG, PA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

DOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION

One stands out!

Take a good look at the Type WAG! It's a rugged device . . . a real performer in the high pressure switch field, both from the point of engineering design and quality of manufacture.

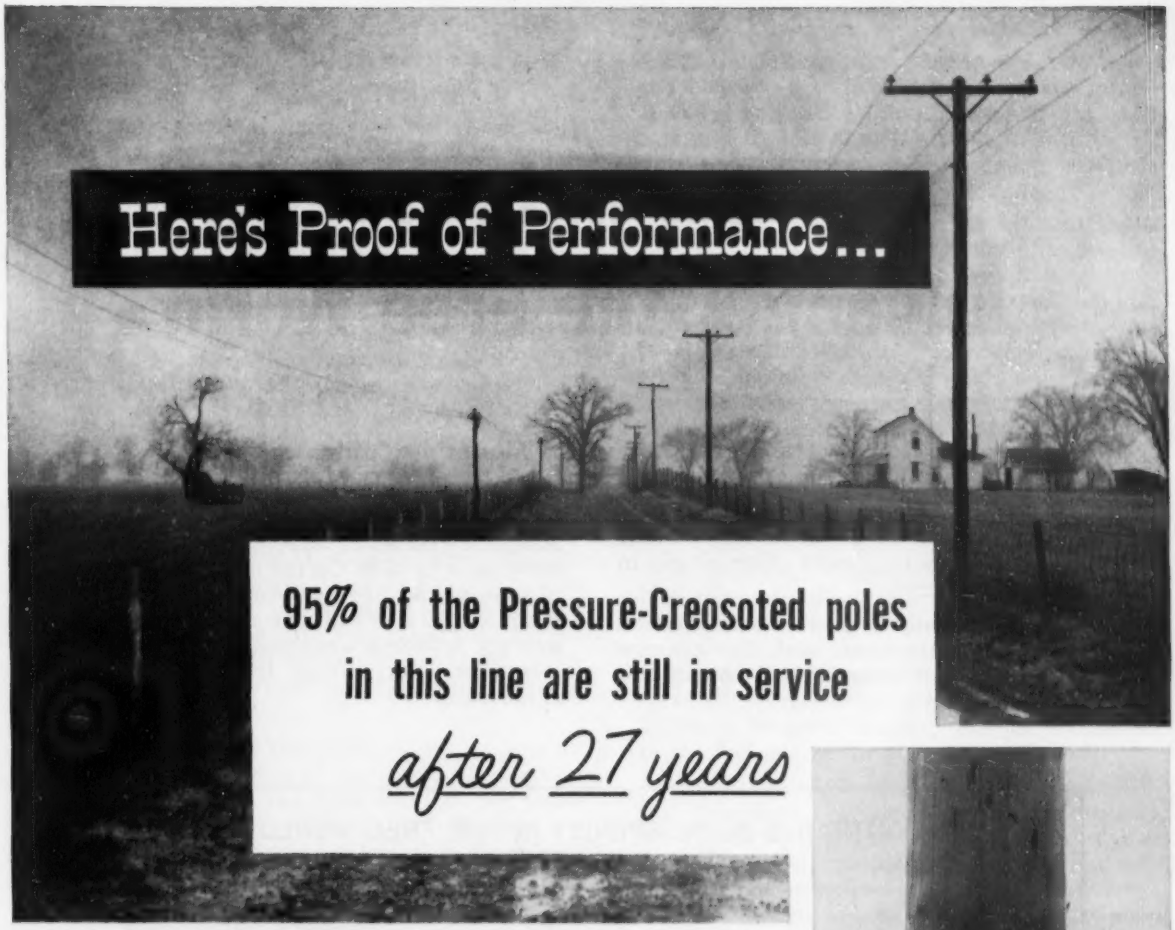
No other switch offers such a combination of vital features: mechanical action that is simple and dependable; more than adequate electrical capacity; ease of operation; freedom from maintenance and a powerful, shearing action for ice breaking.

You cannot afford to gamble with system outages, so choose the Type WAG, the finest switch in its field.

*AVAILABLE: 7.5—230 KV
400-3000 AMPS

*(*For Higher Ratings Contact Factory)*

Southern States Equipment Corp.
HAMPTON GEORGIA



THE POLES on the right are part of a 27-year-old group in a line of Dayton Power & Light Company between Washington Court House and Leesburg, Ohio. Ninety-five per cent of the 1927 poles are "still in fine shape, almost as good as when installed."

CLOSE-UP on one of the poles showing the 1927 dating nail.

• These pressure-creosoted poles, located between Washington Court House and Leesburg, Ohio, were installed by the Dayton Power & Light Company in 1927. Today—27 years later—more than 95% are still in service.

Actually, officials of the utility company can recall only one replacement in the line due to rot at the ground line. The other replacements were the result of line improvements.

Records like these, established on the lines of many of the nation's leading power and telephone companies, are your assurance that pressure-treatment with Creosote is the way to get maximum pole life.

* * *

You get uniformly good results from Creosote treatment when USS Creosote is used. That's because USS Creosote is a uniform product, the result of continuous processing in the plants of United States Steel. For complete information on USS Creosote, contact our nearest Coal Chemical sales office or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS CREOSOTE

USS

4-494

UNITED STATES STEEL

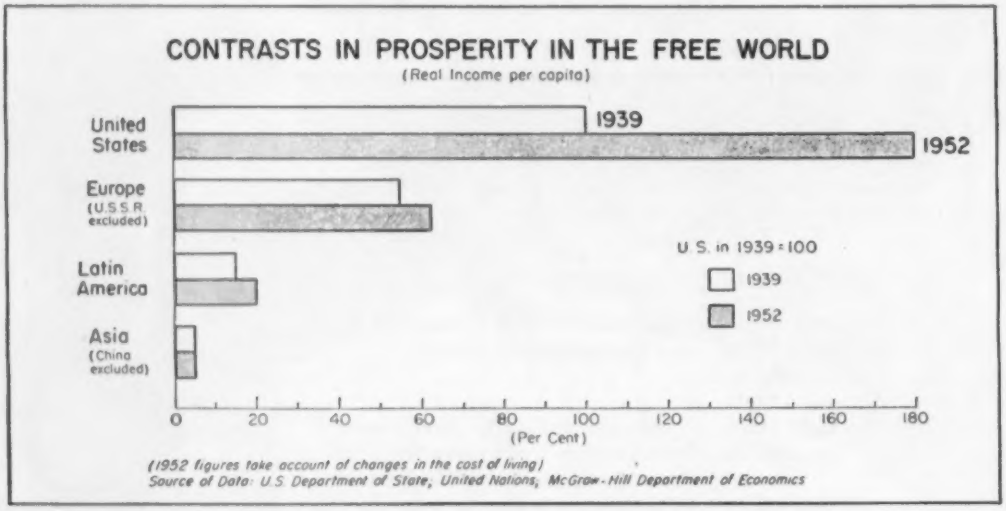
Contrasts in Prosperity Endanger the Free World

The chart in the middle of this page summarizes a situation of profound importance to every American. It shows that:

1. On the average, Americans are vastly better off economically than most other people in the free world, and
2. In recent years the gap in income between the average American and the average European, Latin American or Asian has greatly widened.

A Mounting Contrast

Even greater is the contrast between the real incomes of Asians and Americans. Today most Asians are no better off economically than they were back in 1939. On the other hand, the real income of the average American has almost doubled. As a result, the real income of the average Asian—always small by our standards—is now only a tiny fraction of that of Americans.



The chart shows that, at the outbreak of World War II, the real income (that is, actual purchasing power of income) of the average American was substantially higher than the average European's and much higher than the average Latin American's or Asian's. Since then, the European and Latin American have become better off. But the improvement in the economic lot of the average American has been so great that the others have been left far, far behind.

It must be remembered that the figures used to construct the chart are of varying quality. The fact is that few of the poorer countries have reliable statistics. However, it is generally agreed among competent observers, that the figures here presented offer a correct impression of the wide disparity in the average of real incomes between various parts of the free world. The figures, of course, have nothing decisive to say about spiritual and cultural values. In these, coun-

tries with relatively little material prosperity may be rich.

It is possible to draw a variety of morals from the story of lagging growth of income in other parts of the world. For one thing, it reflects the dynamic force of private enterprise. Private enterprise is characteristic of our economy far more than it is of most of the other free economies. The chart also reflects the fact that we are bountifully blessed with the natural resources essential to a high level of real income. Moreover, we did not suffer from the devastation and waste of two world wars as did many of the other free nations.

Narrowing the Gap

But perhaps the most important message which the chart conveys is one of warning. It warns that something must be done to narrow the gap in prosperity between America and other parts of the free world, if that world is to be united successfully in the struggle against totalitarian Communism. Writing in the HARVARD BUSINESS REVIEW, Kenneth E. Boulding recently put it this way:

> *"The crux of the problem is how to raise the three-quarters of the world that live on a low level to the high level of the other quarter, for it is precisely this wide disparity that makes our world so unstable. American-Russian relations, for instance [are] . . . complicated almost unbearably by the fact that each power is competing for the support of the vast fringe of underdeveloped countries . . . These countries are dissatisfied with their present state and are hovering between the two cultures, wondering which offers them the best chance of shifting from their present low-level to a high-level economy."*

Very real danger threatens from any feeling which may develop in the less fortunate free nations that our enviable economic progress has been made at their expense. Instead of viewing the American economic system as a model that might be followed by their own countries, they may be led to see in it a menace to their well-being. If Communist propaganda can persuade these people that their alliance with the free world will only result in their dropping farther and farther behind an increasingly prosperous United States, they will be driven to the side of totalitarianism.

Test of Effective Leadership

How can these free nations on the lower half of the income ladder be helped to alleviate the conditions that keep them there? Surely this question poses a whole series of complicated problems. Yet, if we do not exercise some effective leadership toward their solution, we can be sure that Russia will take advantage of the situation. In these circumstances, it is essential to both the stability and security of the free world that we help our less prosperous neighbors make satisfactory headway.

This does *not* mean that the United States should sacrifice its own economic progress in favor of some sort of global leveling scheme. On the contrary, a continually expanding and stronger economy is essential if we are to provide any real aid to our friends. Also, it goes without saying that our friends must be disposed to do all they can to improve their own economic position, if our cooperation to that end is to be effective.

Great Skill Required

Our part in a program to achieve this goal calls for a high degree of skill and statecraft. It involves international trade policy, which, in itself, presents a perplexing range of problems. It involves also programs of foreign technical and economic assistance. And expanded foreign investment must play a key role in a balanced program to strengthen the economies of the free world for our common good.

The Commission on Foreign Economic Policy, headed by Clarence Randall, has recently submitted a report, embodying the results of a monumental inquiry into our foreign economic relations and measures to improve them. From the very nature of the subject, discussion of the report is bound to be attended by much controversy and conflict. However, an awareness of the facts presented by this chart should inspire us to accord to the problems posed by the Randall Commission the careful and sober consideration they must have if any real progress is to be made in raising the general standards of human well-being throughout the free world. Our willingness and ability to do this have now become the real test of our statesmanship, both at home and abroad.

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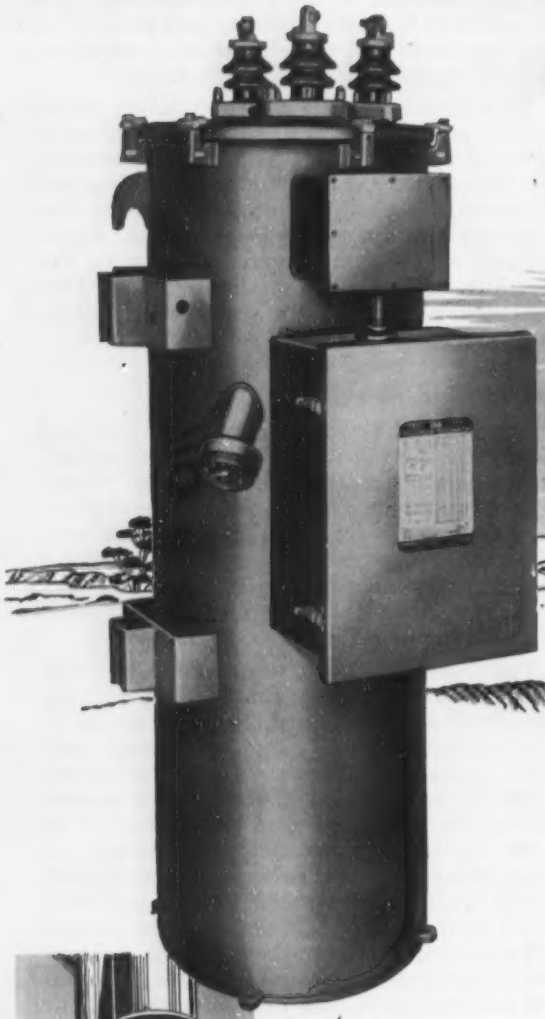
Donald C. McGraw

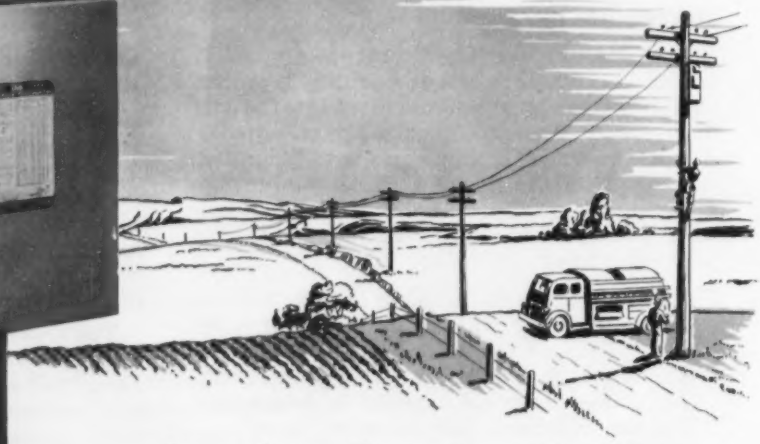
PRESIDENT

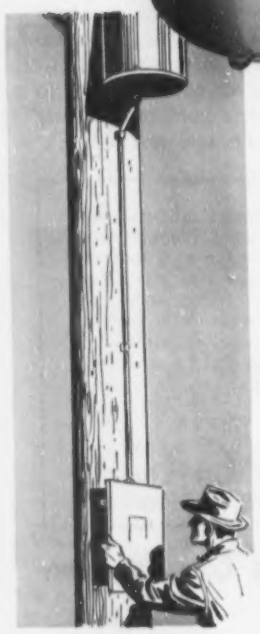
McGraw-Hill Publishing Company, Inc.

CUT INSTALLATION TIME with

POLE TYPE STEP VOLTAGE REGULATORS







Control cabinet contains all control equipment. Hinged front panel is gasketed and is secured by two toggle clamps affording both weather-proofing and accessibility. Cabinet is bolted to tank wall and may be removed for mounting at the base of the pole. Terminal Board easily accessible, permits front wiring of all incoming control wire, yet is easily removed for access to rear panel control equipment wiring.

Construction crew time is real money these days . . . but now you can save much of that valuable time when you install the new Moloney Pole-Type Step Voltage Regulators. These *all-new* regulators can be hung in much less time for they need no external power supply for installation and calibration of the automatic control equipment.

This outstanding Moloney Regulator, engineered to solve real operating problems is factory shipped for immediate installation . . . needs only to be connected to the line and calibrated to proper value. After the voltage regulating relay is balanced, the regulator can be switched to automatic for years of dependable service.

Specify these *all-new* Moloney Pole-Type Step Voltage Regulators . . . they are built with all the care and precision that have been the mark of Moloney for over fifty years. Specify the finest . . . make it Moloney *all along the line.*

MEES-50

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Adequate Wiring—3 Facets of a Hard Problem*

1—Utilities Are Lagging in Promotion

In his keynote address Walker L. Cisler, president, Detroit Edison Co, prophesied that 1954 would mark the turning point in our efforts to reach the goal in wiring promotion. He told of the interest of the retailers in the problem. He referred to the continuing efforts of the National Electrical Manufacturers Association and the appointment of its committee to study the whole problem of adequacy of wiring, including its engineering, safety, educational, and promotional aspects. He pointed to the work of the National Association of Electrical Contractors and the National Association of Home Builders. He even congratulated the members of the daily press on their attention to this important subject. But there was one group to which he did not and could not refer—the electric utilities.

Individually many utilities are doing outstanding jobs in trying to solve the adequate wiring problem. Among them are the electric companies in St. Louis, Cincinnati, and New York. But he could cite no unified industry action as in the case of the other groups. The utilities are just lagging.

The industry coordinating committee, which includes EEI, NEMA, NAED, NARDA, IAEL, and NECA, is a natural place for leadership in extending the wiring promotional effort. Here is a great opportunity for the EEI representatives to step to the front and lead the industry to victory over its greatest foe—inadequate wiring.

And all power suppliers must support them by taking the leadership in their own service areas in coordinating local activities of all elements promoting adequate wiring.

If these things are done, Walker Cisler's prediction is certain to become a reality.

2—Wiring Is Never Adequate

When we refer to a wiring job as "adequate," we are deceiving the customer. "We compound that felony when we 'certify' that it is adequate." This blast at adequate wiring promotion was fired by M. E. Skinner, vice president, Union Electric Co of Missouri. But as usual Skinner followed his criticism with some constructive advice. He suggested that one of these slogans be adopted: "Planned Wiring for Electrical Living," "Wired to Serve Well," "Wired for Growth," or "Wired for Modern Living—Electrical, of Course."

There is considerable logic behind his proposal. As he pointed out the inadequacy of wiring dates back to the invention of the incandescent lamp. The wiring for lighting systems was adequate until the electric iron was invented. Then it became inadequate. When wiring became adequate to handle lighting and ironing, another appliance came along. Again wiring was inadequate. That has been the history of wiring. To change that history for the future, Skinner offered three suggestions:

1. When you sell an appliance, sell the wiring with it.

2. When you have sold the appliance and the wiring, try to sell the wiring for the next appliances the customer will want.

3. Get out and sell wiring at all times.

If all electric companies will follow these three suggestions, customer relations will be greatly improved; and wiring will cease to be the industry's greatest bottleneck.

3—The Customer Doesn't Understand

Whether the industry talks about "adequate wiring" or uses some other term, it doesn't make a bit of difference to the customer. He doesn't understand what the industry is talking about.

This has been confirmed by a survey conducted by Olive P. Gately, vice president, Fuller & Smith & Ross, Inc. She found that on the average neither the husband nor the wife knows anything about wiring or its adequacy.

If wiring is ever to be sold, it must be understood by those buying it. They must be educated to appreciate the necessity for better wiring. This is a job that electric suppliers can do well. And the sooner they start this job, the sooner the problem will be solved.

*Based on speeches delivered at the tenth annual National Adequate Wiring Conference, Feb. 25-26, at Chicago.

Insulations Defying Standardization

Numerous tabulations have appeared showing the electrical and other properties of synthetic resins. Generally speaking the particular chemical family to which a new dielectric belongs is a fairly good index of its applicability in the electrical field. This comes about because the chemical molecular structure shows how intimately the components are related and how stable the compound is likely to be. "Generally speaking" is used advisedly because seldom, if ever, is a new synthetic used in a strictly pure and solo sense. Almost invariably it is combined with other materials—many that were used exclusively until the field was invaded by the new resins. And, of course, different degrees of polymerization, retention of accelerators and inhibitors, and addition of colorants all affect the critical electrical properties.

Tendency to resort to these new materials is increasing at an accelerating pace. The standardizing groups have found difficulty in classifying them under ASA (insulation) classes A, B, or H. The present dilemma arises first from the fact that it is not feasible to group them by chemical compostion alone and second from the inability at this stage to base the classification on experience. Also it may be permissible to subject certain composite installations to higher temperature than normally permitted for the lowest temperature component.

In order to make some progress in the face of a condition hardly conducive to standardization, the AIEE Rotating Machinery Committee has drafted a tentative test code which is now out for trial and comment. It outlines procedures for evaluation of insulation so that there will be a better guide to application in electrical machinery and to appropriate temperature classification.

For the present the evaluation would be based on a set of prescribed tests which can act as a guide to decision. Anyone who uses electrical machinery should be aware of this move to bring the new insulations into the fold of standardization.

No Unemployment for the Qualified

Since 1929 the darkest cloud over the American economy has been unemployment. Today that cloud is again arising. Its presence has already been noted by newspapers, union leaders, and economists. Eagerly, almost too eagerly, they are alarming the people to its presence. For this, they say, is the cloud that brings the rains of depression.

But this cloud like all the others that bring the rains may be bringing a great blessing to all industry and all Americans. As the parched lands need a certain amount of rainfall; so does our economy need the rainfall of more available workers. It is a paradox that as more and more industries turn workers from their doors, countless other industries and professions are seeking workers that they cannot find.

Full employment has been a curse as well as blessing. With jobs requiring little skill or ability available to all. With these jobs paying wages nearly equal and sometimes far more than some college graduates have been getting, there has been no incentive for our youngsters to acquire skill and knowledge, two commodities for which there is always a market. Today the lever-pushers are joining the ranks of the unemployed while still available are thousands of jobs. But these can go only to those who have special skills. The trained craftsman and the college-educated man are still in demand. For them there is no unemployment.

Perhaps those walking in the ever-lengthening line of unemployed will recognize this. The more intelligent among them may seize this opportunity to learn a trade or to acquire more education. Those who followed this course in the last depression are among our industrial leaders of today. Those who follow it today will be among our industrial leaders of tomorrow.

They Said, "Electric Lighting Can't Be Sold"

"It can't be done," psychology tells us, is very often only a self-excusing way of saying, "I don't want to try it." This thought comes to mind whenever we hear an electric utility man telling why electric house heating can't be sold against the lower cost of coal, oil and gas.

Many were the head shakings, the predictions of failure, when Edison's "light in a bottle" was young, when a few adventurous souls risked their money on the idea that it could be sold to the American people. Kerosene and gas were so much cheaper. Had they been right, they who in that day said "It can't be done," we would not be celebrating Light's Diamond Jubilee this year.

The years proved that other ways of lighting were not competitive with the electrical way. The proof came because some men refused to admit the other ways were competitive. Electricity, they said, was so much better that comparative costs did not count. And electricity took the fire out of lighting. There are those today—and Electrical World stands with them—who believe with great faith that electricity will take the fire out of comfort heating, too. And they who say, "It can't be done," are invited to look back at the beginnings of the electrical industry.

A Refrigerator on the Second Floor!

Is the future of the refrigerator on the second floor?

If you take the "second floor" to mean the sleeping quarters of a modern home, the question is not so foolish as it sounds. The refrigerator has long been entrenched in the kitchen or nearby. So far few refrigerators have landed in the sleeping quarters. But certainly there is a place for them, at least for a small one, upstairs.

Some cosmetics and medicines keep better or must be kept under refrigeration. The baby's formula belongs there. Refreshing drinks for babies, the sick, and the aged require cooling. And pop shouldn't be forced to sneak down to the kitchen "to raid the ice box."

Some 40 million refrigerators multiplied by two or any fraction of two wouldn't make a bad additional load for the nation's power suppliers.

THE ELECTRICAL WEEK

The Issue's News Highlights . . . Interior officials meet with potential customers for Missouri Basin power this week to discuss allocations problem.

TVA's Clapp charges utilities consistently have underestimated nation's power needs . . . Northeast Consumers Conference criticizes GE for newspaper ads supporting private Niagara development . . . Georgia co-ops blast Interior's plan to distribute Clark Hill power.

Two bills to curb South Carolina Public Service Authority (Santee-Cooper) were introduced in the state legislature. First would require legislative approval of any agreement the Authority makes; second would cut directors' terms of office from seven to two years.

Power Policy Committee of four Northwest governors has plans under consideration for the states to share benefits and costs of proposed hydroelectric projects across the Canadian border. Studies include an analysis of benefits which U. S. and Canada would receive from developments in the other's territory.

In the same area, Kaiser Aluminum & Chemical Corp officials are investigating the possibility of investing in hydro development on the Columbia River in British Columbia. The firm states that a Feb. 25 conference with province officials was one of a series to secure information on possible Canadian power developments, "in view of the fact that Pacific Northwest power developments in sight are not adequate to provide for the expansion of aluminum and other electro-process industries."

Boston's Suffolk County Superior Court Judge Francis J. Good ruled that Puget Sound P&L must turn over its stockholder list "on or before March 15" to a shareholders committee headed by Laurence M. Marks of Laurence M. Marks & Co, N. Y. Committee seeks to elect directors favorable to a merger with Washington Water Power.

Tri-State (Wyoming, Colorado, and Nebraska) Generation & Transmission Association announced it received "tentative approval" from REA Administrator Ancher Nelsen for a $10.5 million loan to build a 40,000-kw steam power plant. Four sites are being considered: two in Wyoming and two in Nebraska.

General Electric Co suspended the seven employees who refused to answer questions of Sen Joseph R. McCarthy regarding Communist affiliations at a recent hearing in Schenectady, N. Y. This brings to 17 the number suspended by GE under its policy to discharge employees linked to Communist activities.

World's first completely inner-cooled generator went on the line last Monday at Niagara Mohawk Power Corp's Charles R. Huntley Station.

Off the Washington Wire . . . Utility groups lost out in fight to have the House Public Works Committee provide payment for utility relocations in the Federal Aid Highway Bill. The measure calls only for a study and report by Feb. 1, 1955.

Once the St. Lawrence Seaway bill is out of the way, the same committee will turn its attention to legislation which would knock the "sole supplier" clause out of TVA power sales contracts.

Prospects are dim for writing any power marketing policy into omnibus flood control and waterway bill.

Management survey of BPA is under way. Purpose is to improve its service and tighten organizational structure. J. L. Jennings, Portland, Ore., businessman, is chairman of the survey group. Other members: Carl Forsbert, executive vice president, Wisconsin P&L; Otto Eckert, general manager, Board of Water & Light Commission of Lansing, Mich.; and John G. Marr, director of Interior's Technical Review Staff.

Kentucky Utilities Co asked FPC approval to merge its two subsidiaries, Dixie P&L and South Fulton L&P, into it . . . Lower Valley P&L, Freedom, Wyo., has purchased Star Valley P&L for $285,000 and Jackson Hole P&L for $310,000.

Washington Water Power and IBEW Local 77 signed a contract calling for a 5¢ increase in journeymen linemen's base pay . . . Across the country, another IBEW local filed unfair labor practice charges against Potomac Electric Power, saying the company prevented distribution of union literature on company property and otherwise interfered with organization attempts . . . IUE-CIO and Westinghouse agreed to a local supplement to a master contract, ending a 40-day strike of 240 workers at a repair plant.

Paul V. Hayden, vice president of Connecticut L&P, was named president of Connecticut Development Credit Corp at its first annual meeting.

Central Hudson G&E dedicated its 25,000-kw Neversink hydro plant at Grahamsville, N. Y., last week. Plant is the first to use a part of New York City's drinking water to generate power for private consumers.

Detroit Edison Co has received legislative approval to purchase 88 acres of state-owned submerged land in Lake Huron, to be used to build a power plant.

Executive Changes—Alfred V. Coleman, assistant to the president of New England Electric System, was elected a vice president . . . Alfred L. Hartridge and Stuart F. Kosters were named vice presidents of Stone & Webster Engineering Corp.

At Issue: Allocating Missouri Power

Interior Department to lay groundwork for distributing new basin capacity among preference and non-preference customers at Colorado and Wyoming meetings

Interior Department is moving toward a showdown this week in the heated controversy over allocation of power from new projects in the Missouri River Basin.

Immediately at issue is the allocation of some 124,000 kw of additional federal capacity between preference and non-preference customers in Colorado, Wyoming, and a small portion of Nebraska. Meetings between Interior power officials and potential customers for this power are scheduled for Denver today and tomorrow (March 9 and 10) and for Casper, Wyo., Wednesday.

Power Over-Subscribed . . . Flareup is almost sure to come on a recently completed study by Bureau of Reclamation which contains a tentative allocation of the new power, and indicates preference customers have overestimated their 1956 power needs by some 53,000 kw.

The bureau study, which is mainly an analysis of applications for federal power from the western division projects in the basin, shows that customers have requested nearly 74,000 kw in excess of the 124,000 kw which is to become available. The bureau reviewed all applications and gave its own estimates as to customer needs for federal power.

Comparison between customer applications and bureau estimates follows:

	New capacity available 1956	Customer applications	Bureau estimates
All customers	124,000kw	197,728kw	106,180kw
Preference		130,876kw	76,290kw
Private Utilities		62,960kw	26,440kw
Industrial		3,892kw	3,450kw

The bureau estimate of 106,180 kw for all customers leaves 17,820 kw of firm power unallocated. It further shows a tentative allocation of 29,890 kw for non-preference customers.

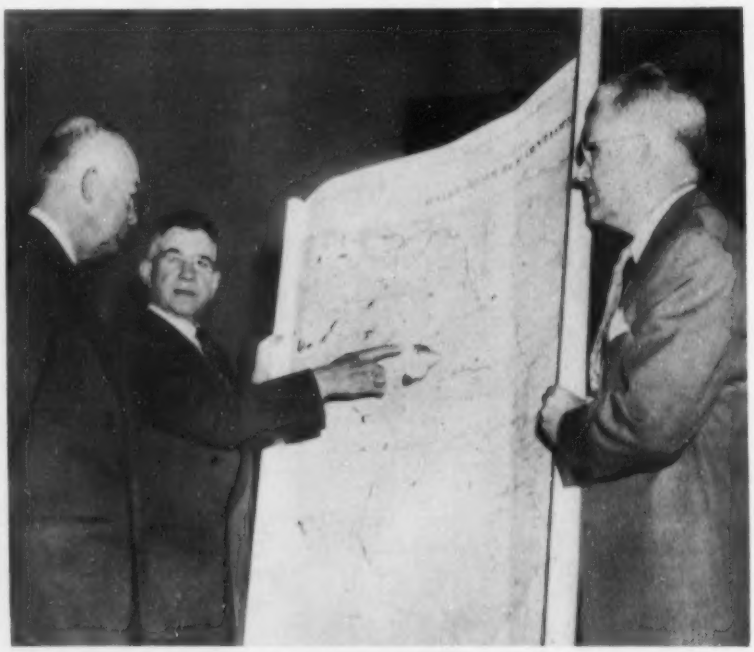
Preference Defended . . . It is these two amounts—the surplus and that tentatively allocated to non-preference customers—that are expected to be the center of controversy at the meetings this week. Preference customers in the basin have heatedly contended that all federal power should be made available to them when and as it is needed.

They have demanded that withdrawal clauses be written into contracts with non-preference customers in order that power will be available for preference needs. Contracts now in effect with non-preference customers in this area all contain such clauses.

On the other hand, Interior officials have indicated that certain privately owned utilities in the area have become dependent on this source of power and have a right to continued supply. Instead of withdrawal clauses, they have suggested short-term contracts for non-preference customers.

Aandahl on Hand . . . Assistant Interior Secretary Fred G. Aandahl will head the Interior delegation to the Colorado and Wyoming meetings. He will be accompanied by Assistant Reclamation Commissioner Harvey McPhail and Reclamation's power chief, Henry Taliaferro.

Tentative allocation of the new power proposed in the Reclamation study is certain to be the basis for discussions with the preference and non-preference customers seeking additional federal power. Whether



Ike Gets Water Resource Map

President Eisenhower was given a 4½ by 6½ ft map last month picturing all the federal government's water resources activities. Secretary of Interior Douglas McKay, center, and Undersecretary Ralph Tudor made the presentation on behalf of the Interior Department, Army Corps of Engineers, and Tennessee Valley Authority. The map shows the flood control, irrigation, municipal water supply, navigation, and power development activities of the government. Map may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Cost is $2.25.

agreement can be reached or not, it will be up to Aandahl and the Reclamation officials to offer power contracts based on the final allocations.

The meetings scheduled for this week are the latest developments in a controversy which has been raging since the Missouri Basin power marketing criteria was announced by Interior last September.

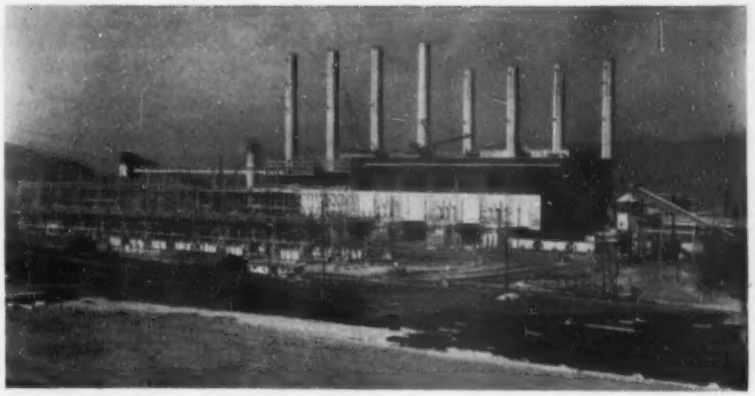
Preference customer groups have directed an almost continuous barrage of fire at the criteria, which is one of the most concrete examples of the Republican power policy announced last year. Hearings have been held by both House and Senate committees on the Missouri power situation.

Most recent attack on the Missouri Basin marketing criteria came last week from Clyde T. Ellis, executive manager of the National Rural Electric Cooperative Association, testifying before the Senate Anti-Monopoly Committee.

Ellis charged that Interior plans to allot non-preference customers a share of Missouri Basin power, in effect, creates a "super-preference" class of customer. These, he said, are made up of utility companies who have become dependent on a federal source of power.

Ellis also criticized Interior for failure to build transmission lines to carry federally produced power to preference customers in the basin. This, he said, will result in giving preference customers a lower priority than non-preference customers which can be served from present facilities or through wheeling arrangements. "This will leave many of the relatively small farmers' co-ops and power districts stranded," he continued.

Purpose of his testimony, Ellis explained, was to show that the Missouri Basin criteria "must be eliminated or drastically modified."



World's Largest Steam Plant?

When Tennessee Valley Authority's Kingston Plant on Watts Bar Lake is completed, it will be the largest steam project in the world, the agency claims. First unit of the $213-million plant was placed in commercial operation last month. The unit has a capacity of 150,000 kw. Located two miles northeast of Kingston, Tenn., the plant eventually will have nine generating units with a combined rated capacity of 1,440,000 kw and a combined capability of 1.6 million kw. The plant, at 80% load factor, will burn more than 4 million tons of coal in a year.

Action Freeing SPA Funds to Benefit G&T Co-ops

Congress and the Republican Administration moved quickly last week to save at least two and possibly five generating and transmission cooperatives in the Southwest from acute financial embarrassment.

The twelfth-hour action lifts restrictions on the use of the Southwestern Power Administration's continuing fund, permitting the agency to continue its wheeling and power purchase contracts with the co-ops. Without the contracts, the co-ops would face a severe financial setback.

Both House and Senate Appropriations Committees last year had banned use of any federal funds for G & T co-op contracts after Feb. 28 of this year. Last week's action will permit the contracts to continue until the end of the fiscal year, which is June 30. This will give the co-ops and SPA time to work out other arrangements.

SPA had obligated approximately $314,000 under the co-op contracts up to Feb. 28. The action makes some $366,000 available for use between now and June 30.

Immediately affected are the Central Electric Power Cooperative in Missouri and the Western Farmers Electric Cooperative in Oklahoma. Both these co-ops sell power from their recently completed steam plants to SPA and also wheel SPA power to member distribution co-ops. Three other co-ops involved are N. W. Electric Power Cooperative, Kamo Electric Cooperative, Inc, and M & A Electric Power Cooperative, all in Missouri. Transmission facilities under construction by these three could be leased or rented to SPA on the same basis as the contracts now in force.

In an appearance before the House Appropriations Committee in late January, Assistant Interior Secretary Fred G. Aandahl pleaded for permission to use available funds for carrying out interim contracts with the co-ops beyond the Feb. 28 date. The House committee gave its permission soon after, but the Senate Appropriations Committee still had not forwarded an official letter lifting the ban early last week. It had, however, given informal approval.

TVA Rejects Offer to Buy Power from 2 Utilities

The offer of two private power companies to sell electricity to the Tennessee Valley Authority for the Memphis area has been rejected as "too high," TVA said late last month.

The offer came from Arkansas Power & Light Co and Mississippi Power & Light Co. It set a price of 6 to 9 mills per kwhr for 450,000 kw.

The price quoted "was so much higher than TVA's price to its distributors that we couldn't give the offer serious consideration," an authority spokesman said.

The 148 municipal and cooperative systems distributing TVA power last year paid an average price of 4.3 mills per kwhr. Memphis' municipally owned power company paid an average of 3.88 mills.

Utilities Err on Power Needs . . .

. . . Gordon R. Clapp charges in lecture. TVA chairman claims the industry consistently has underestimated requirements

More reserve capacity in the power industry will serve as a stimulus to economic growth and a bulwark to the nation's defense, declared Gordon R. Clapp, chairman of the board of Tennessee Valley Authority, in a lecture delivered late last month at the University of Chicago.

The lecture was one of six given by Clapp on TVA under the auspices of the Charles R. Walgreen Foundation for the Study of American Institutions.

Clapp contended utilities have had a notoriously consistent record of underestimating power requirements of the nation. He agreed that such estimates are difficult to make, but said that when they err consistently in the same direction there must be a reason. In his opinion there are two: (1) Utilities do not take into account the effect of new or potential uses of electricity and (2) "there is a 'built-in' psychological conservatism on the part of forecasters who evaluate the market for products of high investment industries." He noted further that "money markets do not reward risk taking in the utility business."

Walter Sammis, president of Edison Electric Institute and Ohio Edison Co, answered "no comment" when asked for his views on Clapp's charges.

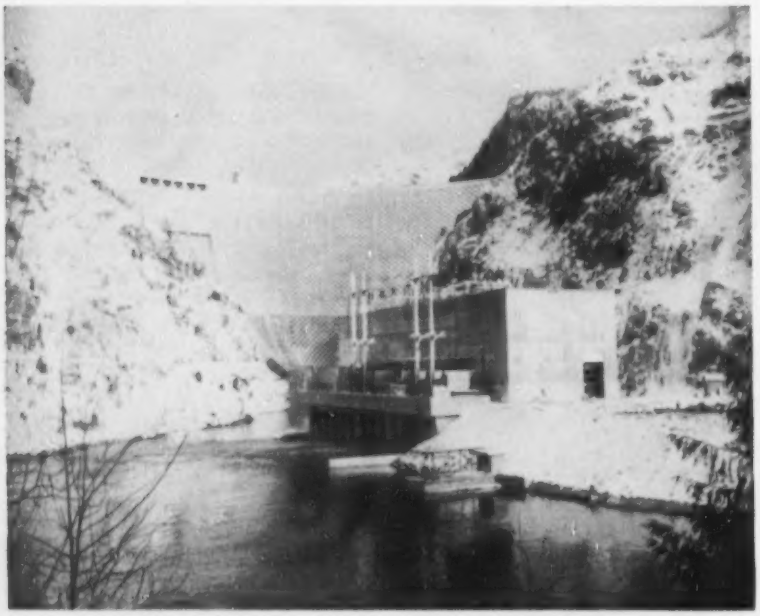
Competition as Stimulant . . . The TVA chairman did not propose that the government take over the power business as a solution to the problem. But he did express the view that the competition between the public and private power groups should be encouraged, that public power programs should be continued and their growth carried forward. Competition between the public and private power groups, he said, was in the public interest and should be stimulated.

To overcome the problem of heavy investments required in the power industry and reluctance of investors in that field to incur risks of overexpansion, Clapp proposed that the government stand the losses from actual excess capacity that may be developed. As one possible way of doing this, he suggested that the government take non-voting preferred stock at interest rates that would be just enough to cover the government's cost on the money.

Raps Tax Plan . . . Clapp criticized the present program of setting up a five-year tax amortization period for new capacity because, he said, it is based on estimated condition of capacity and demand and not on actual conditions as they develop.

Using rates as the basis for comparison of performance of private and public groups, Clapp declared that the cost of producing a kwhr and delivering it to the ultimate customer is 5.4 mills compared with 10.1 mills for the nation's privately owned utilities. Both figures, he said, were before interest, taxes, and profits. The lower costs in the TVA area Clapp attributed to lower costs in customer accounting and collection, sales promotion and administration, and economies in transmission and distribution.

Effect on Investors . . . Clapp denied that public power developments had been harmful to utility investors and said rates of return on private utilities surrounding public power systems had been higher than return for those farther from such projects. Likewise, said Clapp, rates have been lower near the public power projects and, in general, increase as the distance from the public power project increases.



There's No Fall Like Snowfall

Heavy snows in the upper Skagit Valley provide good news for Seattle City Light. All three 90,000-kw generators in this new Ross powerhouse at the base of Ross Dam are now operating and plans are being made to install a fourth. The snow water will be used not only at this plant but at downstream plants.

Other cheery news is that precipitation during January in most areas of the upper Columbia River Basin exceeded 175% of the 1942-51 average, according to report of the U. S. Weather Bureau and Soil Conservation Service.

Southwest prospects however, are less bright, although a heavy storm in California in mid-February alleviated fears of water shortages in some areas of that state. Plentiful water supply was reported for the north coastal and Sacramento Valley, but a shortage was forecast in the San Joaquin and Santa Clara valleys, the central coastal region and southern California.

Consumers Group Scores GE...

. . . for advertisement placed in New York newspapers advocating development of Niagara power by five private utilities

General Electric Co officials are the latest supporters of private power company development of Niagara Falls to come under public attack. Applying the cudgels were several speakers at the first meeting of the Northeast Electric Consumers Conference, which was held in Albany Feb. 26-27.

Setting the pace was Kenneth Peterson, field representative for the International Union of Electrical Workers, CIO, speaking for what he called "a majority of General Electric's workers."

He said that GE's advertisement carried in many newspapers in favor of the five power company plan to harness Niagara power (EW, Feb. 8, p 66) was "in repudiation of everything GE directors should be for." "It was," he said, "against the interests of the people, its stockholders and its workers."

He was supported by Elwood Swisher, president of United Coke & Chemicals Workers of America, CIO, who observed:

"We cannot hope to offset a single advertisement of the General Electric Co, which took the side of the utility companies against the interest of their own workers . . ." (Hearings on several bills providing for development of Niagara power are being held this week by the Senate Public Works Committee.)

Resolution Support . . . These views were singled out in the statement of goals adopted by the 160 delegates present from New England and Middle Atlantic states.

"We condemn the action of the General Electric Co in joining this propaganda campaign against the best interests of their employees, stockholders, and the public welfare," the statement said.

The statement further urged "the Congress and all state legislatures to investigate and expose the unwarranted and malicious propaganda legislative activities of the private power companies . . ."

Among speakers at the sessions were Franklin D. Roosevelt, Jr, and John E. Burton, New York State Power Authority chairman, who repeated their positions, respectively, for and against developing Niagara power with preference allotments for cooperatives and public agencies. Other speakers included: Alex Radin, general manager, American Public Power Association; C. A. Oliver, APPA president; Clay Cochran, economist, National Rural Electric Cooperative Association; and Leland Olds, former chairman of the Federal Power Commission.

Wide Sponsorship . . . The conference was sponsored by seven CIO and AFL labor unions, three farm groups, the Municipal Utilities Associations of New York and Massachusetts, and the Northeast Rural Electric Cooperatives Association.

It was the first regional meeting patterned on the model of the Electric Consumers Conference held in Washington in May, 1952. Its statement of goals urged the officers and executive committee of the organization to affiliate with the Electric Consumers Information Committee, set up to promote the interests of Electric Consumers Conference.

New Public Power Group Organized in Northwest

A new public-power group has been organized at Seattle to combat "attacks on public power in the Northwest."

J. C. Unger, long-time friend of public power, is chairman of the "Citizens Committee to Save and Promote Public Power," with Jack Cluck, Seattle attorney, as vice chairman.

Directors include Harold Gibson, prominent labor leader; Charles M. Carroll, Seattle city councilman; Harry J. Martin and Joseph Gluck, Democratic leaders.

The group will cooperate with the Hells Canyon Association, the Washington PUD Association, and similar organizations in programs designed to protect low-cost public power, Unger said.

House Unit Opposes 2 USBR Dams

Construction appropriations recommended for Reclamation Bureau in House Interior bill were expected to run some $20 million higher than President Eisenhower first asked for. But the change in construction funds foreshadows no increase in Reclamation power projects.

On the contrary, two reported decisions by the Interior subcommittee of House Appropriations Committee indicated rejection or delay for a pair of Reclamation dams involving power features.

One of these was the Missouri River diversion dam in northeastern Montana, where the structure was to provide for eventual installation of an 18,000-kw power plant. Bids for the dam were opened in early February, but the contract award has been held up, pending decisions by the Congressional appropriations committees.

Because of a local controversy over the proposed irrigation project at the site, the House subcommittee refused to vote any fiscal 1955 construction money for the dam. This in effect kills the project for the present and quite probably for a long time into the future.

Second of the proposed dams passed over by the subcommittee was the much larger Yellowtail project on the Big Horn River in southern Montana. A dam 520 ft high at this site would store 1,375,000 acre-ft and supply water for a 200,000-kw power plant.

Yellowtail Dam is fully authorized, according to an opinion last month by Solicitor Clarence A. Davis of the Interior Department. But the House subcommittee apparently had not heard of this opinion or was not ready to accept it. The dam was put over for consideration by a later Congress.

Requests for both these projects came along after the President's budget had gone to Congress. Eisenhower himself gave a broad endorsement to an increase in Reclamation funds, and the bureau prepared a list of projects—including the two dams.

Clark Hill Plan Hit

Co-ops protest proposal for distribution of power, ask more time to file counter-offer

Verbal blasts have been directed at the Eisenhower Administration's plan for the disposition of electrical power from Clark Hill Dam. The new plan, announced Feb. 17 by Assistant Secretary of Interior Fred Aandahl, was described as "window trimming," and as veiling a circumvention of federal laws.

The plan permits Georgia Power Co to handle all power allotted to Georgia from Clark Hill project (EW, March 1, p 6).

The attacks were made at a meeting attended by 91 representatives of the Georgia Electric Membership Corp, a state-wide association of rural co-operatives. GEMC is a foe of the Administration's reversal of public power policies followed by Democratic Administrations.

In addressing the Atlanta meeting, Ellis Arnall, former governor of Georgia and special counsel for GEMC, said "this is an unholy situation that needs to be aired before all the people, and if we can't settle it any other way, we will go before the Supreme Court."

Resolution Adopted . . . Delegates to the GEMC meeting unanimously adopted a resolution asking the Department of the Interior, marketing agency for federal power, to extend by at least 60 days the 30-day time limit given to rural co-ops for studying the new plan and the filing of counter-proposals.

Draft contracts would call for the Georgia Power to sell a guaranteed volume of power to rural co-ops as a "preference customer."

Title at Issue . . . Arnall, however, declared that the crux of the case is not the preference privilege for transmission facilities or rate-fixing. Instead, he said, "the heart of the matter is the preference to title to the power, and title rests with the one who gets the power at the busbar."

The GEMC counsel said, "The question of transmission of power and rate-schedules can only stem from the possession of title. If the power company has title to the power it could change the rates in the future and we could do nothing about it."

HENRY DEWOLF SMYTH

Leaving AEC?

Professor Henry DeWolf Smyth, member of Atomic Energy Commission since 1949, reportedly will leave the commission soon to accept a post at Princeton University. Smyth was chairman of the Department of Physics at Princeton from 1935 to 1950.

Congress to Move Slowly on Atomic Legislation

Congress will move slowly on legislation to permit industrial development of atomic power, but chances for action this session appear to be improving.

Bill proposing amendments to the Atomic Energy Act to permit broader industrial participation is to be introduced in Congress within the next few weeks. This will be a product of the Joint Congressional Committee on Atomic Energy, and will be the basis for action this year.

Committee sources now believe that public hearings will be scheduled about mid-April on this legislation at which time utility representatives and others will have a chance to present their views.

Meanwhile opposition to the changes appears to be slackening. Democratic Representative Chet Holifield of California, who has been an outspoken critic of industrialization of atomic energy, is moving toward a less adamant position. In a statement in the Congressional Record recently, he supported wider dissemination of nuclear power information to industry while standing firm against fundamental changes in the act.

POWER BRIEFS

● Mississippi Power Co expects to build a generating plant in the Gulfport-Biloxi area on a recently acquired 700-acre site. The initial 100,000-kw unit will cost an estimated $15 million. Ultimate capacity of the plant is put at 500,000 kw.

● Public power leaders will get together in Washington May 10-11 for another protest against Administration power policy. The meeting, to be known as Electric Consumers Conference, will be more of a "workshop" affair this time rather than the mass protest meetings such as those previously held in Washington and Denver.

● Puget Sound Power & Light Co now is considering a 55,000-kw addition to its White River hydroelectric plant. The plant, located near Auburn, Wash., has a 61,000-kw capacity.

● British Electricity Authority plans to amalgamate the North Western and the Merseyside and North Wales Generation Divisions as an experiment to obtain experience in the working of a unit larger than the existing divisions. To be inaugurated April 1, the enlarged operating unit will be known as the North West, Merseyside and North Wales Division.

● Western Massachusetts Electric Co's 1954 plans call for a $2.5-million, 115-kv, 7.33-mile transmission underground cable and substation job to provide a new source of bulk power supply from West to East Springfield. Since more generating capacity will be needed by 1957, Pres H. J. Cadwell said a third unit for the West Springfield station is contemplated.

● International Bank has approved an $18.8-million loan to Brazilian Traction, Light & Power Co to help finance the construction of a 160,000-kw thermal electric power plant and expansion of other generating facilities near Sao Paulo.

● Residential electric consumption on the Nashville (Tenn.) Electric Service system increased 22.73% in January compared with a year earlier. The increase, from 81,171,392 to 99,625,428 kwhr, was attributed to temperature drop in January to an average 39.6 deg from 1953's average 43.7 deg. About 21% of all Nashville residential consumers now heat their homes with electricity.

SPEAKER W. C. Sontun, vice president, Pennsylvania Electric, drives home point while E. L. Schlottere, vice president PEA Engineering Section; Communications Committee chairman C. H. Conrad, Penelec; R. N. Youtz, Pennsylvania W&P; C. D. Cordes, Penelec, listen

System Operating Standards...

. . . advocated by Bryner of West Penn Power Co at committee meeting of Pennsylvania Electric Association

Operating standards must apply systemwide, W. G. Bryner, West Penn Power Co, told the Pennsylvania Electric Association Systems Operation Committee at Johnstown, Feb. 18. They should be controlled by an independent organization representing all interested groups in the company.

Immediate investigation of every error is essential, continued Bryner. "Inattention to detail is the principal cause of error." Among the 18 steps he advocated for improvement were continuous education, good tools, and rigid rule enforcement.

Training Personnel . . . Education and training of operating personnel was discussed by R. M. Hutchinson, Pennsylvania Power & Light Co. Basic method comprises annual group meetings of operators, linemen and substation personnel, he said. At such meetings both the philosophy of system operation and typical problems are presented by the question-and-answer technique, Hutchinson added.

System voltage control by coordination of generator voltage, transformer tap setting, and switched capacitors were described by F. M. Reed, Pennsylvania Electric Co. These capacitors are switched by voltage with current compensation to recognize both voltage and reactive load. He cited cases where the combination provided 30% voltage rise, 20% from capacitors and 10% from generator bus schedule. The capacitors switch themselves off during light load periods and generator voltages are cut to avoid system overvoltage, said Reed.

Economies accrue, Reed continued, from loading up existing circuits and deferring construction of new circuits. It is entirely practical, he said, to provide perfect regulation out to the last distribution loads. And emergency conditions are usually better than with additional circuits. Continuous addition of capacitors will be required to match system load growth, he pointed out.

Auto Transformers . . . Rotating the phase angle of 69-kv and 115-kv systems of the General Public Utilities group will permit auto transformers for the expanding 230-kv interconnection, reported R. W. Werts, Metropolitan Edison Co. Savings are estimated at $956,300, even though phase-shift transformers were installed at three existing 115- and 69-kv interconnections, and three other transformers were replaced or reconnected. Changeover was completed overnight Nov. 18-19, he said.

Automatic load control now extends to 30 generating units in six stations of the Consolidated Edison Co system, said J. A. Dourigan. Latest addition is the new unit at Astoria steam station. He stressed the need for adequate instrumentation to guide proper manipulations of a complex system. Present installation includes a frequency corrective bias of 75 Mw per 0.1% deviation from 60 cps, Dourigan said.

Emergency load relief must follow honestly a fair plan to be successful, said W. D. Brown, Duquesne Light Co. He told about one procedure involving several prearranged steps. The first two are initiated by direct telephone request by system operators. Subsequent relief, when necessary, is arranged by power salesmen.

Catastrophe curtailment requires prior system switching to set up separate blocks of load, Brown continued. These can then be dropped almost instantly by station operators. He cited cases where up to 40 Mw had been dropped in 30 seconds.

Those participating in the discussion seemed agreed that such measures could only be condoned on the basis that it is better to drop some load than to lose the whole system.

World Nuclear Parley Set

The first international conference on nuclear engineering will be held at the University of Michigan, Ann Arbor, June 20-25. The meeting, sponsored by the American Institute of Chemical Engineers, is slated to get data on nuclear engineering that will be declassified by the U. S. government for the first time for use at the conference. Over 1,000 engineers are expected to attend, representing Argentina, Belgium, Canada, England, France, India, Italy, Mexico, Netherlands, Norway, Spain, Sweden, the U. S., and Yugoslavia.

Case of hypothetical 20-story building demonstrates opportunity for substantial savings in power system costs may come from . . .

Higher

DONALD BEEMAN and **H. D. KURT,**
General Electric Co., Schenectady, N. Y.

Increased loads are putting modern commercial buildings in the same electric service category as industrial plants. Many of these loads can be served most economically by a higher service voltage. In many plants motor loads and general area lighting loads have been operating on 480-v systems since 1946. As large office buildings have similar load characteristics, they may well benefit by a new standard service voltage that will realize savings as high as $25 to $30 per kva.

Minimum building size at which 480 v becomes economical may range from a few hundred up to a few thousand kva. Determining factors are availability of power supply, type of load in building, and building configuration.

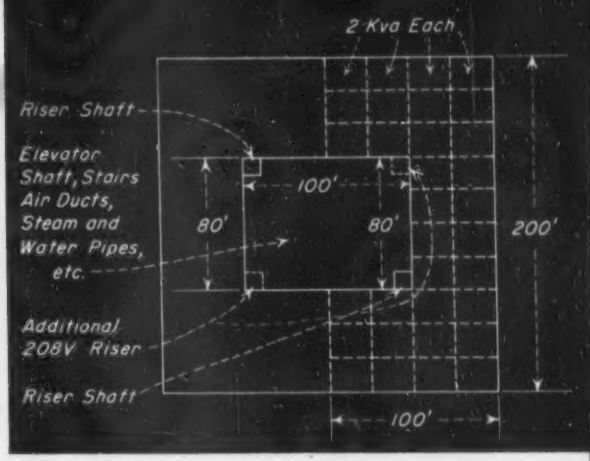
Underwriter-approved components are now available for complete office building installations of 480-v systems with 277-v fluorescent lighting. These include incoming line switching equipment, cable and bus risers, adequately tested and rated panelboards, dry-type transformers for stepdown to 120/240-v miscellaneous loads, and 277-v remote control branch circuit switching or wall switches rated 277 v (300-v class). There are also 265-v ballasts available in reasonable quan-

Total Building Load Excluding Sub-Basement:

	kva
Lighting load, 40 unit areas x 64 kva x 0.8	2,048
Misc load, 40 unit areas x 24 kva x 0.8	768
Motor load—typical floor, 19 floors x 21 hp x 0.6	239
20th floor, 245 hp x 0.6	147
Motor room, 14 x 90 hp x 0.2	252
280 hp x 0.6	168
	3,622

Note: These total loads were multiplied by diversity factors assumed typical of duty expected from various system components. At 480/277v, the 3,622-kva load equals 4,550 amp (460 v).

TOTAL LOAD for hypothetical 20-story building which is fully air conditioned throughout is comprised of lighting, miscellaneous load (office machines, etc), and motors for elevators, compressors, and other equipment



FLOOR PLAN is based on 80% rentable area. Average lighting load is 4 va per sq ft of rentable space. Two kva per 500 sq ft are needed. Unit area is half of rentable space

Network Voltages in Large Buildings

tities for fluorescent lamps usually used for general area lighting in office buildings.

Low Voltage Supply from 480-v Systems . . . In every office building there are miscellaneous loads operating at 120 v. However, power distribution throughout the building from 480Y/277 v makes available only 480 v 3-phase and 277 v single-phase. Yet the building power system must supply business machines, floor lamps, incandescent lamps, fans, electric razors, and other portable devices.

This miscellaneous equipment is now designed and built for operation primarily on 120-v systems. Most of it belongs to the tenants and may be moved by them from one building to another. Introduction of a line of similar devices rated 265 v would prevent interchangeability between office buildings, other than those equipped for the higher-voltage supply, for the miscellaneous portable load.

Safety is another factor in small portable equipment operating at 265 v rather than at 120 v. Experiences in Europe, where 230 v to ground is commonly used in residences, have caused many foreign engineers to attribute an undue number of electrical accidents to the higher voltage.

From an economic standpoint, too, it would not be practical to develop a new line of portable appliances and equipment rated at 265 v. The market would be small, requiring perhaps only 1% of the production of equipment in the 115-v or 230-class.

To supply the miscellaneous load, 120 v can be obtained in two ways. Where the building owner buys primary power and uses load-center unit substations, 208Y/277-v substastations may be used to supply the 120-v load and 480Y/277-v substations to supply the remaining load.

A more economical answer may be in the supplying of 120 v through small dry-type transformers stepping down from 480 v to 120/240 v. There should be no undue economic penalty even where the miscellaneous 120-v load may be as much as five va per sq ft. Only in a few borderline cases will this practice overbalance the other cost advantages of the 480-v system.

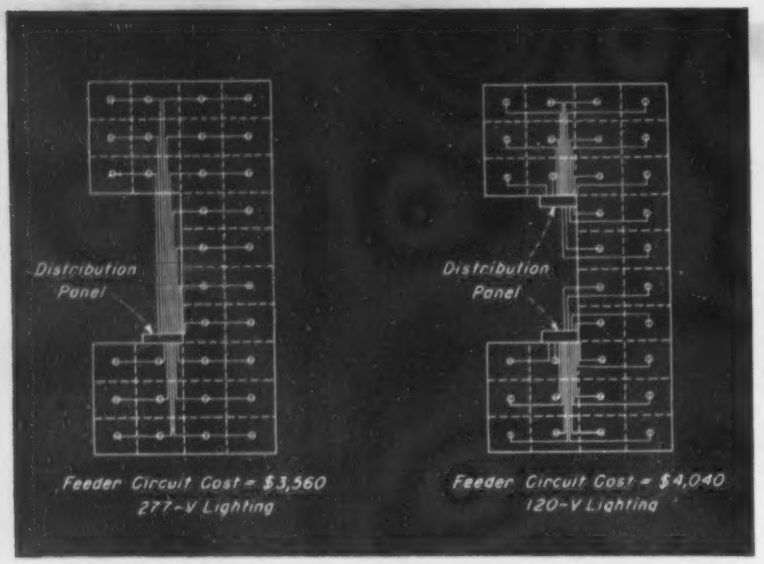
General area fluorescent lighting load is not in the same category as the miscellaneous load. It is permantly installed out of reach of normal tenant activities. Qualified electrical men will maintain such lighting equipment. Therefore, it is safe and desirable to install the permanent general area fluorescent lighting on 277-v systems (ballasts rated 265 v).

Other loads may fall in a category between the portable miscellaneous load and the permanently installed general area lighting. They may be very large business machines, window air conditioners, and similar heavy devices. If these large loads include large fractional or integral horsepower motors, they may be connected

A Matter of Nomenclature

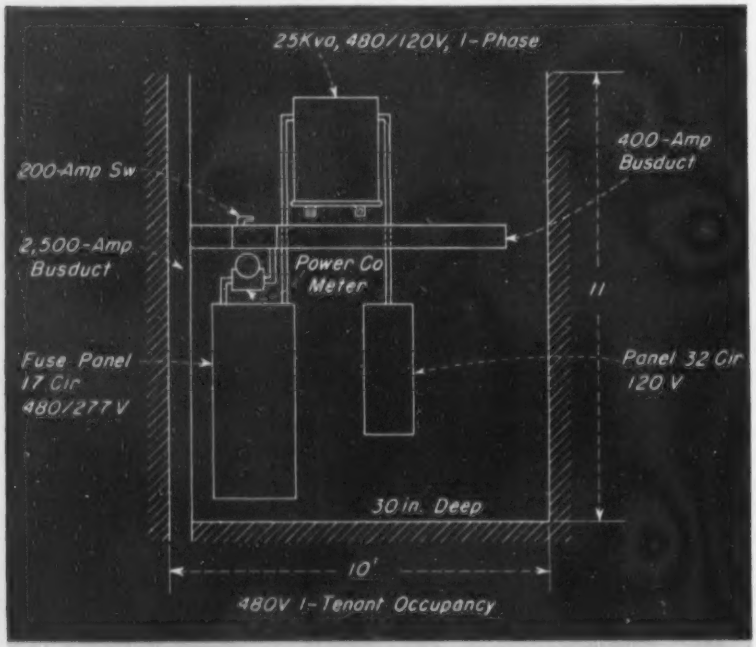
For consistency with industry standards, the higher voltage system under discussion in this article is referred to as 480Y/277 v. This is the EEI-Nema voltage designation for power systems in industrial plants. Voltage spread of such systems is from 420 to 480.

However, many commercial buildings are supplied secondary power by the utility. Voltage spread may be plus and minus from the system name value. Precedent set in designing 208Y/120-v systems may cause the building power system designer erroneously to allow for a voltage spread above and below 480. Some power companies may prefer the designation 460Y/265 v. It is merely a different name for the same 480Y/277-v system.



UNIT AREA LIGHTING for 277 v, left, requires 16 feeders and costs $2 per circuit ft. For 120 v, right, the same lighting requires two riser shafts, two distribution panels, and more wire to overcome the objectionable voltage drop that often occurs in branch circuits

SERVICE ARRANGEMENT for single tenant features plug-in busduct to meet needs for future



Equipment and Installation Cost—Single-Tennant Service

		Total Installed Cost
5 ft	400-amp busduct	$ 90
1	200-amp fusible switch	125
1	Fuse panel	690
1	25-kva, single-phase dry transformer*	560
1	Panelboard, 32 circuit	160
17	Current limiting fuses (150 & 20 amp)	95
		$1,720

*Price increased to next larger size to cover special mountings for elimination of sounding board effect.

to the 480-v system through permanent wiring back to the panelboard. Where only single-phase motors can be employed in such equipment as window air conditioners, these motors should be rated 230 v. Consideration should be given to 480 v only where standard 440-v motors are available in size and type of motor required for the devices.

Short-Circuit Protection . . . When selecting switching and protective equipment, there are important differences between 480Y/277 v and 208Y/120 vs:

- Arcing faults at 208 v tend to be "self clearing". But 480-v switching equipment must be designed to confine the arc within adequate interrupting chambers.
- Circuit impedance at 480 v has less of an effect on the available short-circuit current. Higher rated protective equipment is required for the 480-v system, but it also will function promptly to isolate the fault.

Adequate short-circuit protection can be obtained throughout the building as long as the short-circuit duty at the main switch-board does not exceed 100,000 amp at 480 v. Switchboards rated 1,000 amp are readily available to meet the needs of any commercial building.

Service Entrance Switches . . . Circuit breakers rated 100,000 amp can be used for service entrance switches. But conventional fuses commonly used in 208-v systems generally are not adequate for 480-v system application. There is a line of high interrupting capacity silver-sand, current limiting fuses which are claimed by the manufacturers to be adequate for 480-v systems having duties as high as 100,000 amp. These fuses require a load interrupter switch which has a momentary rating equal to the let-through current of the fuse.

Panelboards . . . Short-circuits are not reduced so rapidly with lengths of cable or bus at 480 v as they are at 208 v. In many systems nearly 100,000-amp short-circuit current will be available at the panelboards protecting the branch circuits.

Exploratory fuse-circuit breaker tests indicate that 277-v panelboards containing 20-amp rated type-AT or ATB circuit breakers can be protected for an available IC as high as 100,000 amp. This protection can be

supplied by current limiting incoming line fuses of current rating as high as 150 amp. In such a combination of current-limiting fuse and circuit breaker, a fault close to the panelboard may blow the 150-amp fuses as well as open the circuit breaker for a branch circuit fault.

If fusible panelboards are used, then silver sand, current-limiting fuses should be employed for main circuits and individual branch circuits. NEC fuses without high short-circuit rating should not be used for either main or branch circuits because the duty may exceed their design limits and produce pressure explosions.

Branch Circuit Switching . . . Tests on panelboards and on branch circuit switching devices have shown 20-amp silver-sand fuses will adequately protect a remote control relay if the available short circuit current is not greater than 25,000 amp. This limit is adequate because the No. 12 wire of the branch circuit between the panelboard and the light switch has a relatively high impedance. It will reduce the short-circuit current from 100,000 amp at the panel board to 25,000 amp for any fault more than 7 ft from the panelboard. Tests have not yet shown whether the circuit breakers with 150-amp silver-sand current limiting fuses in the mains will protect remote control relays and wall switch contacts at fault currents as high as 25,000 amp.

Motor Starters and Bus Risers . . . When motor control centers are used, reactors can be placed in the incoming line section to reduce an available short-circuit current of 100,000 amp to 25,000 or 15,000 amp for the motor starters.

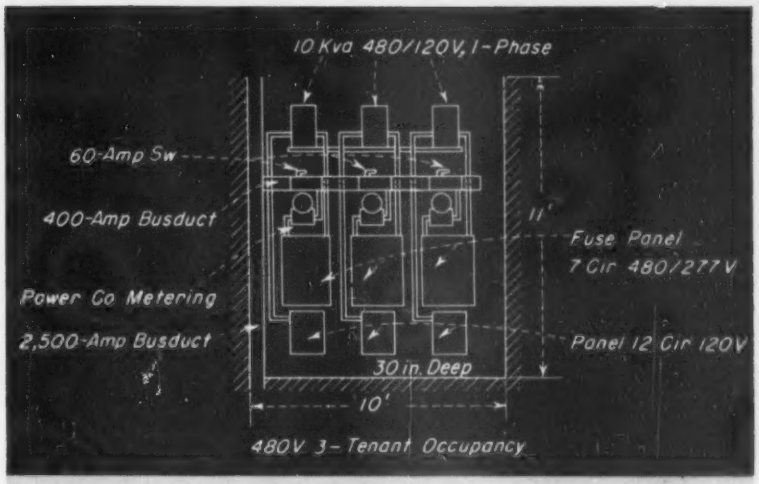
With individual motor starters the highest short-circuit current rating of the fusible type is 50,000 amp. Either reactor or cable impedance must be inserted to reduce the short-circuit current from 100,000 amp to 50,000.

Bus risers are available with 100,000-amp short-circuit capacity.

Very Large Systems . . . In very large systems supplied from a secondary network bus, the short-circuit current at the network bus may be above 100,000 amp. Service entrances not larger than 4,000 amp can reduce the short-circuit current at the building switchboard.

Even in the worst cases, it is expected that an electrical circuit distance of 30 ft from the power company's network vault bus to the building owner switchgear bus will be ade quate to reduce the current to 100,000 amp. If service entrance switches in this run must be located closer to the power company's network bus than to the building's switchgear bus, it may require service entrance switches with short-circuit current ratings as high as 150,000 amp. Manufacturers can supply 4,000-amp circuit breakers with such ratings.

When buildings have a demand of more than 4,000 amp, the 4,000-amp

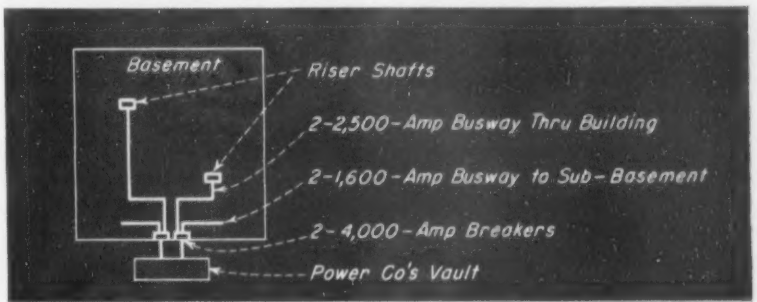


Equipment and Installation Cost — Three-Tennant Service

		Total Installed Cost
5 ft	400-amp busduct	$ 90
3	60-amp fusible switches	125
3	Fuse panels, 7 circuits	1,040
3	10-kva, single-phase dry transformers	860
3	Panelboards, 12 circuits each	225
33	Current limiting fuses (40 & 20 amp)	130
		$2,470

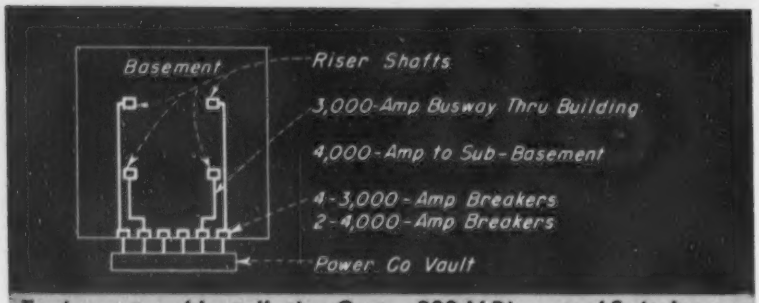
THREE-TENANT SERVICE ARRANGEMENT in same unit area requires three times as much equipment as smaller size. Cost per unit area is up $750. Busduct provides for needs of future

RISER AND SWITCHGEAR arrangement for 480 v requires only two circuit breakers. They are rated 4,000 amp with 100,000-amp capacity. Equipment and installation costs $112,200



Equipment and Installation Cost — 480-V Riser and Switchgear

		Total Installed Cost
820 ft	2,500-amp busduct	$ 78,920
100	1,600-amp busduct	5,750
—	Necessary fittings, elbows & connections	7,530
2	4,000-amp breakers, 100,000-amp IC	20,000
		$112,200



Equipment and Installation Cost — 280-V Risers and Switchgear

		Total Installed Cost
1,640 ft	3,000-amp busduct	$192,700
100 ft	4,000-amp busduct	15,000
—	Necessary fittings, elbows, & connections	15,125
2	4,000-amp breakers, 100,000-amp IC	18,750
4	3,000-amp breakers, 100,000-amp IC	30,000
		$271,575

MORE ENTRANCES AND RISERS at 208 v add to cost. Breakers for each riser shaft and breakers for sub-basement load increase cost to more than double that of 480-v system

service entrances should not be paralleled again in the building because such practice may increase the currents to above 100,000 amp at the switchboard bus.

Cost Factors in Building Systems . . . Installation costs vary widely from one area to another. In all the specific cost comparisons given here, installation cost has been included as an average of 25% of the material cost. As installation costs go up, the differential increases in favor of 480 v compared to 208 v because there is generally more equipment to be installed in a 208-v system.

Main Switching Equipment . . . In the cost comparison, 600-v magnetic air circuit breakers have been used in both 480-v and 208-v systems. Other types of switching equipment, such as fused switchboards may be used with a slight reduction in the cost differential in favor of 480 v.

The number of circuits also has an effect on the relative cost of the switching equipment. There should be a real saving in the main switchboard of the 480-v system advantage is taken of the 480-v load current being lower for the same number of feeders, or if fewer feeders can carry more kva.

Cable or Bus? . . . The greatest saving is in the transmission system throughout the building. It may consist of cable feeders to individual panelboards on various floors, or it may be in bus risers from which each individual floor is fed by a tap-off. The 480-v system always has a distinct advantage because it can carry the same amount of kva with less voltage drop and less copper than 208 v. The longer the run and the heavier the load, the greater will be the saving in the 480-v system.

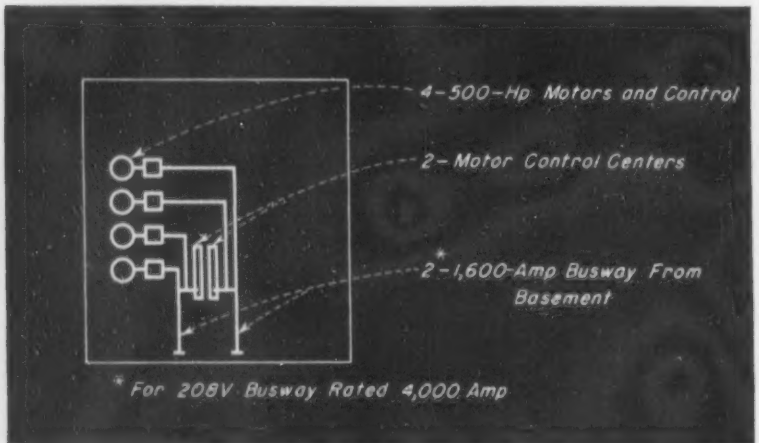
Panelboards . . . A 277-v panelboard generally will be more expensive per circuit than a comparable 125- panelboard. But costs can be held down by loading branch circuits up to their ampere rating so that only half as many branch circuits are needed in the panelboards at 277 v as at 120 v.

Auxiliary Transformers . . . Where the miscellaneous 120-v load is low, about ½ to 2 va per sq ft, the cost of the 480-120/240-v transformers is a small part of the overall savings in the rest of the system. The greater the transformer capacity required for the 120-v floor circuits, the fewer the savings for the overall 480-v system as compared to the 208-v system.

Branch Circuits . . . Savings in the branch wiring to the 277-v general area lights will generally offset the increased cost of the two panelboards and the auxiliary transformers. For convenience of comparison in the cost studies, two No. 12 wires in conduit were used as the basic branch circuit.

Lamp Circuit Switching . . . Wall switching or 24-v remote-control for general area lighting circuits are not

MOTORS THROUGHOUT BUILDING are considered as fed from motor control center in order to make more convenient price comparisons between 208-v and the new 480-v system



Comparison of Motor Control Costs — 480 vs 208 V

	208Y/120 Volts Total	480Y/277 Volts Total
4 500 hp motor controls (Sub-basement)	$ 48,500	$ 42,750
6 Motor control centers	126,250	83,350
	$174,750	$126,100
Installed cost of motor leads @ 1.5 cents per amp ft	12,510	5,400
	$187,260	$131,500

significant in the overall cost comparison because the components cost the same at either voltage.

Fixture Cost . . . At present, large orders of 10,000 to 25,000 ballasts cost no more at 265-v rating than at 120-v rating. Fundamentally, there is no difference in material or design that would make the 265--rated ballasts more expensive than the 120-v rated ballasts when quantity production is under way.

Where starters are used in the two 40-w lamp fixture, there is a slight increase in cost at 265 v. If the four 85-w lamp ballast is used, there is a material reduction in ballast and cost fixture rated 265 v.

Motors . . . Except for very large air-conditioning compressor motors rated above 500 hp, motors cost the same for either 208-v or 480-v systems. Above 500 hp, 480-v motors cost less. There also is a saving in motor control costs for 440-v motors over 5 hp. For example, a 15-hp, 208-v fusible combination motor starter costs $162 list while a similar starter rated 208-v costs $203 list. Individual motor starters cost less than a complete motor-control center although installation expenses add up for separately mounted motor starting equipment.

Motor branch circuits cost less at 480 v because they need less copper to carry the same horsepower. The longer the branch circuits, the greater the saving.

Availability of 480-v . . . If a building is located in an area where only 208 v is available, and autotransformer will be needed to step up to 480 v. The cost is about $8 per kva of building load, but it is still not enough to offset the savings in the 480-v distribution system.

Artificial Restriction . . . At present there are not many artificial restrictions in the application of 480- and 279-v general area lighting in office buildings. It is approved by the National Electric Code and by most local authorities.

Building Size and Configuration . . . A relatively small ground area, very tall building would represent the greatest saving for 480-v systems because of the long copper risers.

Losses . . . The watts loss in the 480-v risers and branch circuits will be materially less than at 208 v. Even though the small dry-type transformers add a certain loss to the 480-system, losses are less than those in the risers and branch feeders in 208-v systems. Total system losses are less at 480 v.

Voltage Drop . . . Risers and branch circuits will have less voltage drop at 480 v than at 208 v or 120 v. But floor circuits will have a slightly higher voltage drop in a 480-v system because of the use of small dry-type transformers. The drop may be 1 to 2%, depending upon the power factor of the floor circuit load and the magnitude of the load relative to the size of the stepdown transformer.

Occupancy . . . In buildings where single tenants occupy large areas and where the number of tenants per floor is about four to six, 277-v general area lighting is practical and economical when the fixtures are supplied by the building owner. Small tenants would not find it economical to purchase limited quantities of 277-v fixtures.

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Summary of Cost Saving—480Y/277 vs 208Y/120-V 20-Story Building

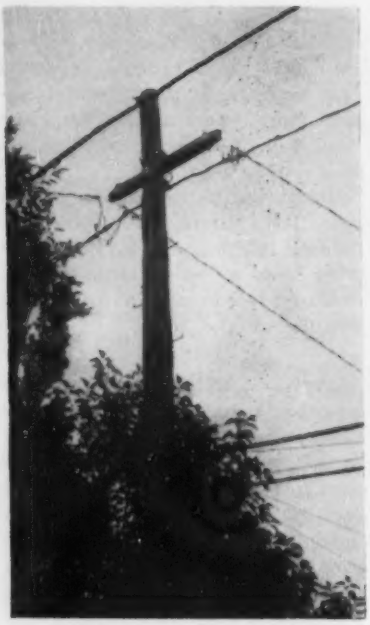
	480Y/277	208Y/120
Wiring (40 Unit Areas)	$142,400	$161,600
Panelboards and transformers (14 UA-one tenant)	24,080	7,616
Panelboards and transformers (26 UA-three tenants)	64,220	15,366
Entrance switchgear and risers	112,200	271,575
Motor control centers	126,100	174,750
4 500-hp motors (air conditioning)	26,400	29,100
Motor feeders	5,400	12,510
	$500,800	$672,517
Omit reactor on 208-v motor control centers		—6,500
Use fused pressure switches on 208-v (for entrance)		—27,500
	$500,800	$638,517

Summary of Cost Saving—480Y/277 vs 208Y/120-V 40-Story Building—Demand of 12,000 kva

	480Y/277	208Y/120
Wiring (80 Unit Areas)	$ 284,800	$ 323,200
Panelboards and transformers (30 UA, one tenant)	51,600	16,320
Panelboards and transformers (50 UA, three tenants)	123,500	29,550
Entrance switchgear and risers	355,310	717,480
Motor control center	156,900	233,600
Four 1,000-hp motors (air conditioning)	65,000	80,000
Four 1,000-hp motor controls	55,000	60,000
Motor feeders	13,000	30,000
	$1,105,110	$1,490,750
Omit reactors on 208-v motor control centers		—13,000
Used fused pressure switches on 208-v (for entrance)		—55,000
	$1,105,110	$1,422,750

Aerial Cable

SEVERE TREE conditions and difficulty of maintaining an adequate tree-trimming program prompted the installation of aerial cable in a 24-block area. Cable reduced the trimming



THREE-PHASE PRIMARY has three conductors with insulation cabled with bare messenger

Eliminates many serious problems including tree trimming in 24-block Midwestern area with heavy growth and is found to contribute to service continuity through ability to support large fallen limbs. No interruptions are attributable to design

J. C. SMITH, General Division Engineer, Commonwealth Edison Co, Chicago, Ill.

Aerial cable streamlines the appearance of overhead construction and makes it virtually trouble free, Commonwealth Edison Co has found on the basis of recent experience. These advantages are additional to the reduction in tree-trimming expense necessary to elminate a major cause of service interruption in overhead circuits.

Tackling the familiar problem of overhead circuits in an area of heavy tree growth, Commonwealth Edison Co's Public Service Co division went to work with specific instructions. It was told to come up with recommendations for design and operating practices for the high quality service required by today's electrical living.

As part of its study, it designed a distribution system for a 24-square-block residential area. In this area, prefabricated aerial cable was installed for both primary and secondary circuits.

This area is part of a community served from a 4.16-kv primary network supplied from three unit-type distribution centers with diversified transmission feeds. Underground conductors are used for the network ties. Within the 24-block area, supplied from one of the primary network ties, two-way feed is provided to all sections of the primary circuits by the use of buried cable.

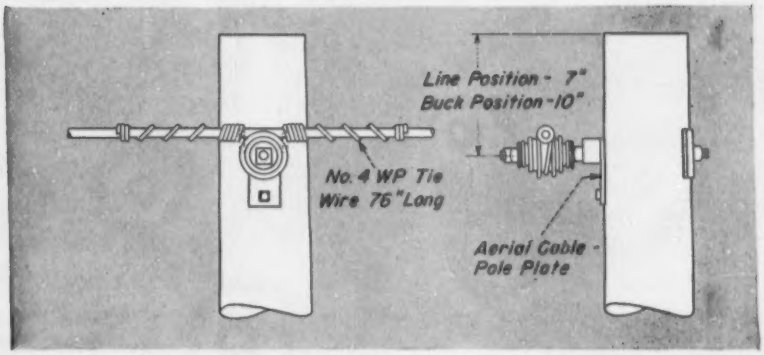
Cable Design . . . The new aerial cable's messengers for both primary and secondary act as a multi-grounded common neutral. These messengers are ⅝-in. bare Copperweld strand.

Three-phase primary circuits consist of standard rubber insulated No. 1/0 aerial cable. For single-phase primary circuits a conductor was designed especially, consisting of a single-conductor, No. 4D Copperweld tree wire, style M-8125-B with 6/64-in. insulation, rubber-filled tape and seine twine braid with Bakelite impregnation for abrasion and weather resistance. This 4D conductor is composed of two 0.1615-in., 30% extra high strength Copperweld and one 0.1615-in., hard-draw copper. This cable is self supporting. On these single-phase circuits the messenger of the secondary circuit acts as the neutral conductor for both primary and secondary.

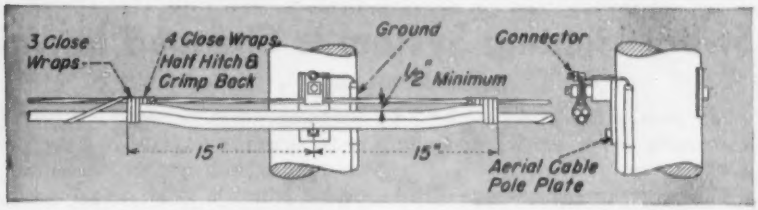
A cable messenger is grounded at the ends, at the transformer poles, and at sufficient intermediate points so that the interval between grounds does not exceed 550 ft. Customers'

Streamlines Area, Cuts Trouble

PREFABRICATED CABLE was used for 3-phase primaries, messenger being neutral cutout

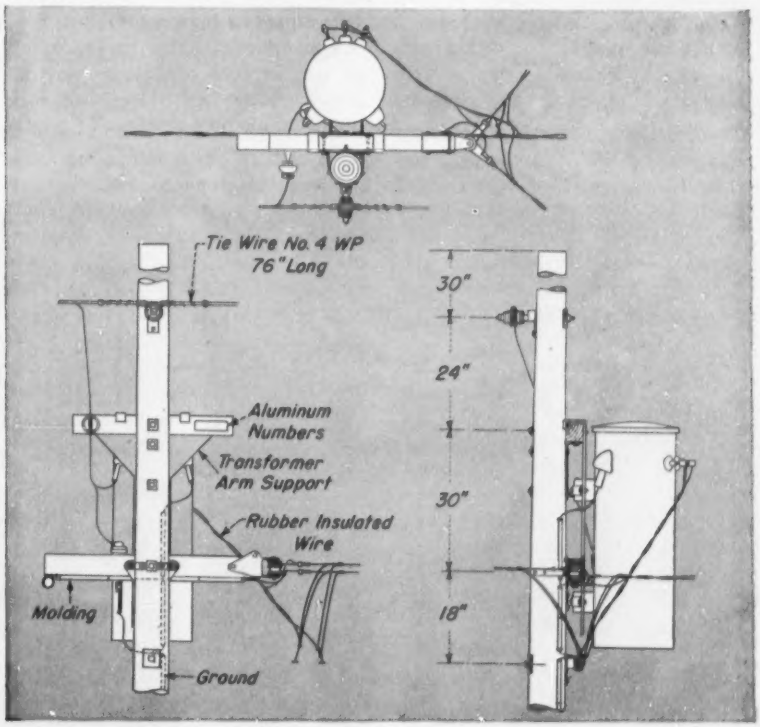


SUPPORT for the single-phase 4D conductor is designed to match the strength of the conductor. On single-phase circuits the messenger of the secondary circuit acts as the neutral

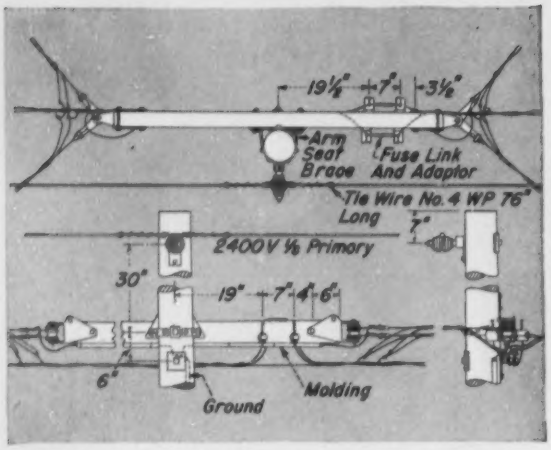


LINE POLE ATTACHMENTS for the 3-phase pre-assembled aerial cable are designed to match the strength of the Copperweld messenger. Minimum pole congestion is another advantage

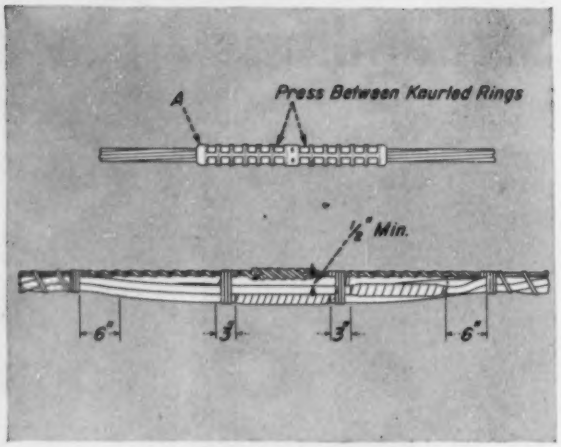
SINGLE-PHASE TRANSFORMER on primary line is practically located in tree top



SINGLE-PHASE TRANSFORMER installation with CSP transformers has been assembled without cutouts on single-phase lines and depends upon internal fuse for protection against failure



SECONDARIES are banked with fuses inserted in phase wires as shown in diagram of a pole carrying a single-conductor 2.4-kv primary



COMPRESSION SPLICES are made on Copperweld messenger of 3-phase, 2,400/4,160-v aerial cable. Conductor splices are made as shown

Street Lighting System Is Changed to Multiple Circuits

water pipe grounds contribute to maintaining a low ground resistance on the system.

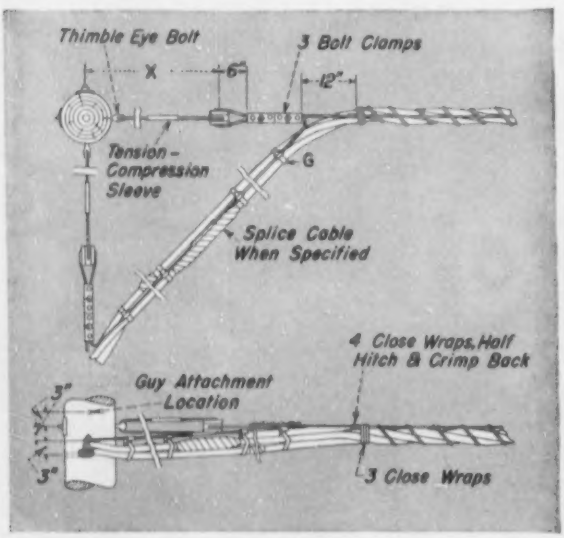
Valve-type arresters were installed at the aerial cable terminals and at transformer installations within ½ mile of open-wire exposure. One set of expulsion arresters was installed on open wire lines 500 to 600 ft from the cable ends. When there was a transformer installation within this distance, the expulsion arresters were installed at that location, replacing the valve type.

Secondaries and Services . . . Secondaries consist of two No. 2 copper conductors with rubber insulation, twisted around a ⅝-in. bare Copperweld messenger. All secondaries are banked through open-type fuses.

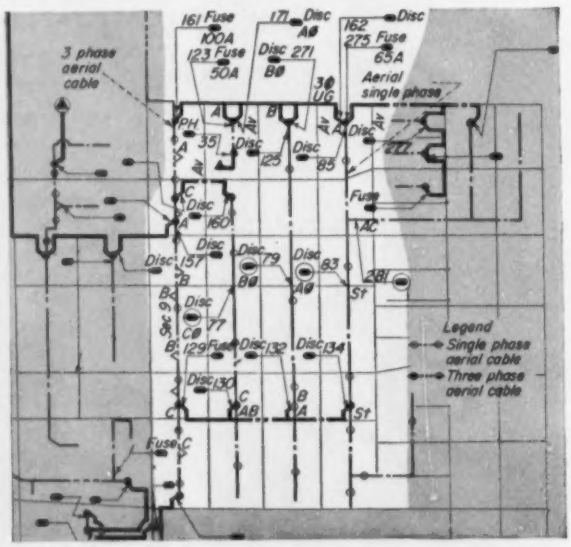
All transformers are of the CSP type, and all services are of No. 6 service cable with two insulated conductors and a bare neutral.

Conventional series street circuits of weatherproof conductors were replaced. Street lights were all connected on multiple circuits with photocell control, one photocell controlling two lights. Two-conductor, twisted-pair, low-voltage cables service these circuits.

Results . . . The appearance of this installation is in keeping with that of the area. The high tensile strengths of the cable messengers and the single-conductor 4D tree wire assure service continuity even during severe storms, for they are capable of supporting sizeable tree limbs until they can be removed.



AERIAL CABLE primaries and secondaries were installed with buried cable cross feeds on streets and secondaries banked through fuses



PRE-ASSEMBLED aerial cable corner with open wire primary is turned with messenger deadended. This construction proved to be practical

Because They . . .

- **Save money**
- **Save manhours**
- **Save time in waiting for a solution**
- **Conserve engineering manpower**
- **Inspire confidence in the results**
- **Reduce factors of safety in designs**
- **Give greater accuracy because fewer simplifying assumptions are necessary**
- **And permit solution of problems previously not practical due to volume of calculation . . . . . .**

AUTOMATIC COMPUTER, the UDEC at Wayne University, has proved ideal for heat balance calculations. Wiring is enclosed during operation

Digital Computers Aid Engineers

T. H. LEE, Associate Engineer,
System Studies and
A. P. FUGILL, Chief Electrical Engineer,
Planning and Project Department,
Detroit Edison Co, Detroit, Mich.

The use of digital computers for the solution of engineering problems in the electric power industry is still in its infancy. However, sufficient work has been done to indicate that there are many problems for which machine computation is advantageous. At the present time each new problem should be examined to be sure that a computer should be used.

Other Savings . . . Sometimes the advantage will be that of obtaining a solution in cases which are at present classified as unsolvable because of the amount of calculation necessary. Here the savings in the final product will result from the use of a lower factor of safety, permissible because of the more dependable design calculations.

No All-Around Computer . . . One road block to the greater use of computers is the poor channel of communication between the computer designer and the mathematician who know what these machines can do in terms of mathematical formulas and the power system engineer who knows his problem but does not know whether that problem can be converted into the form required for solution on a computer. Research in computer application is being carried on by a number of engineers in both operating and manufacturing companies. As different computers have different characteristics, no one computer will serve all purposes.

The Detroit Edison Co started using computers in the solution of its engineering problems more than 30 years ago with the purchase of a dc short-circuit board for calculating system faults. About 15 years ago the system network problems became so complicated the company began using an ac network analyzer on a rental basis. Later, the work-load became so heavy that the company acquired its own system analog and network computer.

The network analyzer type of computer has proved to be a satisfactory device for most system performance studies of the load flow and voltage regulation type. Like all computers, however, it has its limitations and may not be so well suited for other problems in power system engineering.

For instance, one such problem was to determine the effect of system loss on the charges to be made for power transfer between two interconnected companies, under all conditions of interchange. This could be solved on the network analyzer by summing up the losses in every branch in the network under the desired conditions of operation. The time required by this method, however, discourages the solution of enough cases to give the accuracy desired.

A much more satisfactory method is to express the system losses by formula. This formula expresses system losses in terms of the generation at each plant and at each point of interconnection. Solution of this formula —in this case there were eight sources —is economically impractical if done manually, as the solution must be made for many different cases. A desk calculator will solve the 500 cases in this particular problem in about 1,700 man-hours.

Semi-Automatic Digital Computer . . . Fortunately IBM 604 Electronic Calculating Punches which are being used by Detroit Edison for accounting purposes, were available to the engineering department. After experimentation, this machine proved most satisfactory for the solution of this problem.

Originally, the computer was used only to solve the loss formula, the derivation of the formula being done on desk calculators. At present, however, the computer is being used to

What Is a Computer?

A computer is a device which accepts information, performs specified operations, and delivers the result.

An analog computer is a device which simulates the behavior of some actual physical system. In a more complex analog computer consisting of a system of electrical components, the voltages may represent forces or displacements or power system voltages.

A digital computer is a device which counts digits. Thus to multiply 5 by 3, it merely counts up to 5, three times in succession. There are different types:

A manual computer is like a desk calculator.

A semi-automatic computer is like some accounting machines which perform some operations automatically but require human intervention at certain stages.

An automatic computer is like the "electronic brains" which complete solutions without human intervention.

ANALOG AND NETWORK COMPUTER is being used by Detroit Edison to study equipment loading, regulation, and other problems

Many Jobs but There Is a Computer For Every One of Them

derive the formula and to solve it. The total time required for solution on the machine, including problem set-up time, was about 50 instead of 1,700 man-hours.

Automatic Digital Computer . . . The semi-automatic computer was not suited for turbine heat balance calculations for a steam station. A number of such calculations must be made for various loads and cycle arrangements for each turbine generator added to the system. Both a preliminary and a final set of balances are computed. Preliminary balances are used in designing the plant while the final balances are used as a guide in its operation.

The solution involves a cut-and-try method consisting of making certain steam flow assumptions, completing the calculations, and comparing the computed with the assumed steam flow. The operation is repeated with corrected assumptions until results check within a given tolerance. This is a tedious process, consuming many man-hours.

For this solution the company used the UDEC automatic digital computer located at the Wayne University Computation Laboratory. This computer has a magnetic drum storage with a capacity of 5,300 words and an average operating speed of 59 operations per second for addition and 20 for multiplication. The speed of operation is moderate compared with the speed of some of the other high-speed computers. But this computer was chosen in order to obtain a lower cost for the equipment. Most industrial problems, particularly those of an engineering nature, do not require an exceptionally high speed of operation.

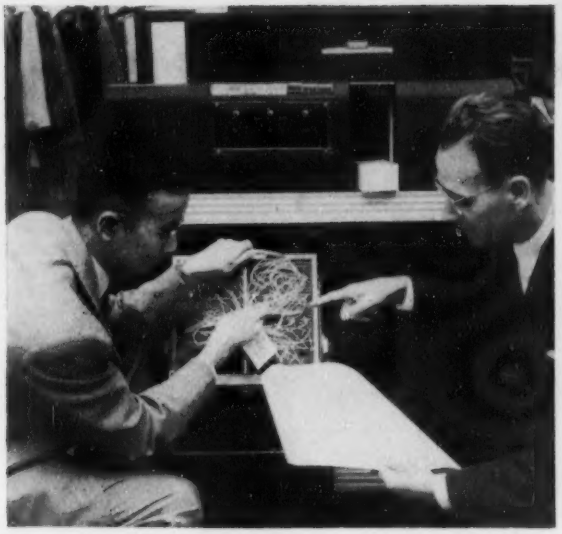
Whenever a computer is considered for a new problem, some investigative work has to be done to adapt the form of the problem of heat balance calculation to the computer characteristics and to check the accuracy of the solution for a typical case. The procedures have now been perfected so that this problem can be solved very satisfactorily on this type of machine.

For other problems Detroit Edison has available the MIDAC computer located at the Willow Run Research Center of the U. S. Air Force. It is operated by the Engineering Research Institute of the University of Michigan. Not only is the computer now available on a limited basis for civilian industrial problems, but a well-trained staff of physicists, mathematicians, and engineers is available for consultation.

This computer has a high-speed mercury delay line storage of 512 words, and an auxiliary low-speed magnetic drum storage of 6,000 words. Speed of operation is relatively fast, 650 to 5,200 operations per second for addition and 315 to 435 for multiplication.

Load Flow . . . Load flow within the system network and the resultant voltage regulation are usually determined on the network analyzer. However, a digital computer can and has been used as this problem consists mainly of the solution of a set of simultaneous equations. In some circumstances, the digital computer solution may prove more desirable. Although with the present knowledge and cost of available computers, it appears that the network analyzer solution will usually be preferred.

System Stability . . . The problem of system stability is usually solved by the step-by-step method whereby a steady-state solution is made on the network analyzer and an analytical solution is made to determine the conditions for the next steady-state condition to be set up. The analytical part of the solution can readily be made on a digital computer with a possible saving in time and with less chance of error. On the other hand, the whole problem may be solved on an electronic differential analyzer. These solutions have not been investi-



ELECTRONIC CALCULATING PUNCH is one of several used in the commercial department but can be used to solve engineering problems

AUTOMATIC COMPUTER, the MIDAC, run by the University of Michigan at Willow Run, is used for high-speed calculations

—Trained Personnel Are Required to Operate Computers

gated sufficiently so that any positive conclusion can be drawn regarding them at the present time.

Incremental System Loss . . . A problem similar to the determination of the charge for power transfer over interconnections is the one of introducing the effect of system losses on the operation of generating equipment for optimum system economy.

Additional load should be picked up by the plant or generator which will give the lowest incremental cost at the load, not at the generator terminals. Particularly in a system where much transmission is involved, the effect of system loss may be very significant. One company believes this factor is so important that a special-purpose computer is being purchased to solve this particular problem for day-to-day operation. For a metropolitan system such a procedure may not be justified under the present state of the art, but a check should be made occasionally on a general-purpose computer to determine whether the factor is large enough to be significant.

Turbine Foundation Vibration . . . In designing the foundation for a turbine generator, it is important that its vibration characteristics be known so there is no possibility of resonance. This calculation is a tedious one. A small special-purpose analog computer was constructed by Detroit Edison several years ago to investigate the problem. Today, this problem could be solved on a computer such as the UDEC, or MIDAC, perhaps with even greater confidence in the accuracy of the results.

Piping System Design . . . Another problem which faces engineers in a system with thermal plants, is the determination of the forces and moments in piping systems caused by changes in length due to variations in temperature or movement of associated equipment. Part of this problem involves the solution of a system of algebraic equations.

This solution could be made on the IBM 604 computer with considerable advantage over the present desk calculator method. In this case, however, it was found advantageous actually to compute the coefficients of the system of equations on the IBM 604 computer as well as solve the equations. This eliminated many man-hours of work previously done on a desk calculator.

Equipment and Personnel . . . The question of computing equipment and specialized personnel necessary is one which must be answered on the basis of the particular situation. Many power companies are already using some computers for accounting purposes. These may be adaptable for engineering problems. The manufacturer of the computer can best answer this question. Should it become desirable to purchase a computer, there are many manufacturers of computing systems who should be consulted in order to obtain one which is best suited to the problems at hand.

The personnel requirement is another matter unless the company is willing to depend entirely on outside consultants. Most power companies have a few engineers with a background of analytical experience and a better than average knowledge of mathematics. They can be trained in a few months to handle the simpler problems. For the more involved ones, it may be necessary to call on the outside consultants. Once the problem has been worked out, the company personnel can usually take over on future problems of a similar nature.

In the average power company, probably not more than two or three specially trained engineers would be needed. The number of technicians for operating the computers would be much greater, depending on the types of problems being solved.

22 Different Appliances Give Sagan Cafeteria 225.79-Kw Load

Main Kitchen	Kw
2 Batteries coffee urns, 10 kw each	20.00
2 Food warmers, 2.5 kw each	5.00
1 Roll warmer	1.00
2 Toasters, 2.5 kw each	5.00
2 Egg Boilers, 1.5 kw each	3.00
1 Griddle	15.90
2 Short order stoves, 4.2 kw each	8.40
2 Heavy duty ranges, 21.9 kw each	43.80
2 Fryers, 10 kw each	20.00
1 Broiler	10.50
1 Vegetable steamer	12.00
1 Stock kettle	10.00
1 Bain marie	4.00
1 Bake oven	18.60
1 Doughnut kettle	12.00
1 Hot plate	4.00
1 Dish washer tank heater	10.00
1 Glass washer tank heater	0.75
1 Proof box	0.75
Total load, main kitchen	**204.70**
Luncheonette Counter	
2 Coffee stations, 0.32 kw each	0.64
1 Toaster	2.45
2 Griddle grills, 4.5 kw each	9.00
1 Roll warmer	1.00
1 Hot plate	2.50
1 Food warmer	0.50
1 Coffee maker	5.00
Total load, luncheonette	**21.09**
Total load, cafeteria	**225.79**

Electric Cooking Reduces Costs

Hartford cafeteria cooks 67,000 meals a month at an energy charge of a half cent a meal. Other savings are reported

E. D. P. GROSS, Hartford Electric Light Co, Hartford, Conn.

Electric cooking which costs but slightly over a half cent per meal is one of the reasons for the success of the Sagan Cafeteria, Hartford, Conn. A second reason is a by-product of such use of electricity, unsurpassed cleanliness.

The cafeteria is no small enterprise. Some $250,000 is invested in real estate, building, equipment, and fixtures. It can serve 192 persons at a time, 164 at self-service tables and 28 at twin 14-stool counter loops at the front of the cafeteria. When planning his establishment, the proprieter was convinced that an all-electric installation would require minimum labor, be compact and speedy, turn out quality foods all the time, and save food costs. Hartford Electric Light Co made studies of the proposed service which supported his convictions. These have since been proved by actual operating experience.

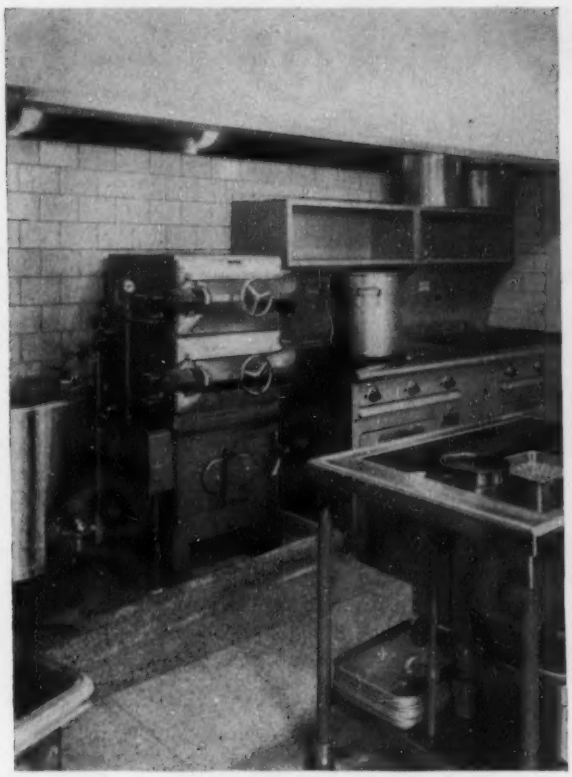
The serving counter is at the rear of the dining room separated from a kitchen laid out and equipped to promote a direct and uninterrupted food flow from receiving to dining. The basement includes an ample general storage area, dairy, vegetable and meat refrigerators, and a walk-in freezer. Vegetables and meats are prepared there. An electric elevator carries supplies to the main kitchen above. A day storeroom is adjacent to the elevator, and ample refrigeration is provided in the various kitchen departments. Heavy duty cooking areas behind a long short order section also include a bakery.

Sagan's serves about 65,000 meals a month with an average check of 44¢. Another 2,106 are served free to 36 full-time and 2 part-time employees, for a total of 67,106 meals. The establishment is open from 6 AM to 9 PM, six days a week. As it specializes in bakery products, the baker works nights; and the plant gets off-peak rates. At daytime the bake oven supplements the kitchen oven in baking such items as meat, fowl, and pies.

Previous to a recent 7.5% increase in Hartford EL's rates, the electric cooking bill for a typical month came to $333.82 or 5.04 mills (5.42 mills after the increase) average for each of 67,106 meals. This was 1.13% of gross take of the cafeteria.

Total cost of all electric service in the month was $790 or 2.68% of the take. This included lighting and auxiliary power but not air conditioning. The ratio of labor cost to take was but 25%, low in relation to the accepted ratio of 30 to 35% as an index of good management. This favorable figure is due in part to the convenience and reliability of electric cooking as well as to the planned layout of the establishment.

Without air conditioning the typical month's usage reached 33,000 kwhr, and the half-hour demand averaged 106 kw. Air conditioning raised these totals to 39,000 kwhr and 129 kw, bringing the bill to $912. Under the new rates this figure would be somewhat higher. This low cost for air conditioning ($122) is due to the fact that electric cooking appliances put the heat where it is needed and do not allow it to escape into the kitchen as is the case when other fuels are used.



MAIN KITCHEN of Sagan Cafeteria has a load of 204.7 kw made up of 26 appliances. Because of duplications only 19 of them are different

SHORT ORDER SECTION shows the advantages of clean electric cooking. If other fuels were used, dining room would be quickly soiled

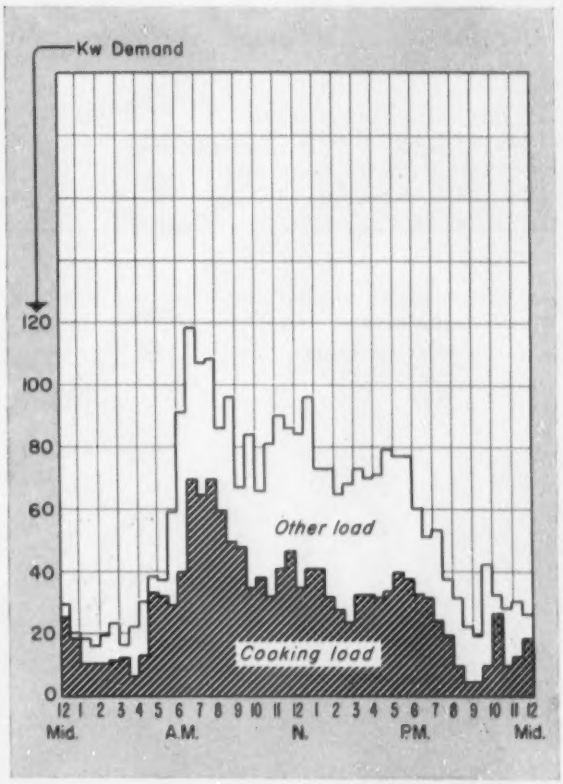
The short order section benefits particularly from electric service through use of large capacity equipment, close heat control, uniformity of food output, more comfortable labor conditions, reduced strain on workers in rush periods, and less waste of food material.

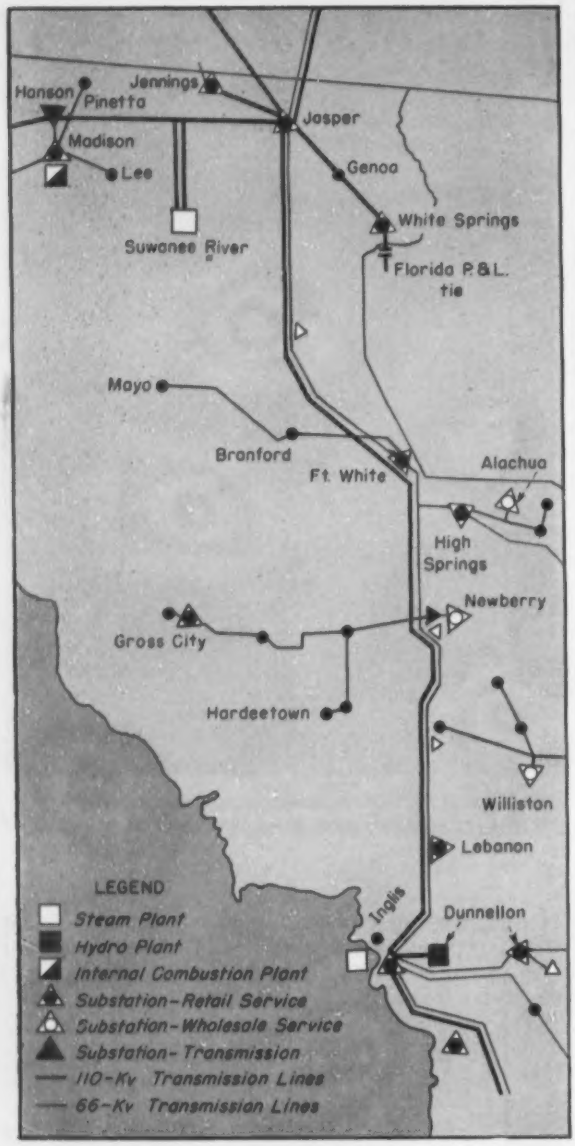
In a representative half-year average watt-hours per customer check were 223, or about 4.5 checks per kwhr of cooking service. Including employee meals, the average was 216 watt-hours per meal. Taking the cooking demand responsibility from 6:30 to 8 AM as 70 kw, its ratio to the 225.8 kw of connected cooking load was 31%.

Test meters were connected to show electric cooking demands and energy consumption. For a representative August day of 24 hours the cooking peak of 70 kw occurred between 6:30 and 8 AM. During the noon rush the maximum was 47 kw, and during the 5 to 6 o'clock evening rush, the demand was only 40 kw.

These figures show the low cost of electricity in relation to the total cost of commercial food preparation and service. Considering its other advantages of cleanliness, employee comfort, speed and customer attraction on which no definite money figures can be placed, the reason is clear why Sagan's regards electricity as a large contributor to successful operation.

The figures show also the desirability of the commercial cooking load to the electric utility. It has a low demand factor and, since all of the installed equipment is in regular use, this infers a good load factor. The highest demand occurs in the morning, comfortably removed in time from the peak load on the electricity supply system.





Capacitors Solve

66-kv bus installation supplies I^2X losses on 110-kv double-circuit transmission line

H. K. McKEEN, Vice President, Florida Power Corp
J. T. LOGAN, Consulting Engineer, St. Petersburg, Florida

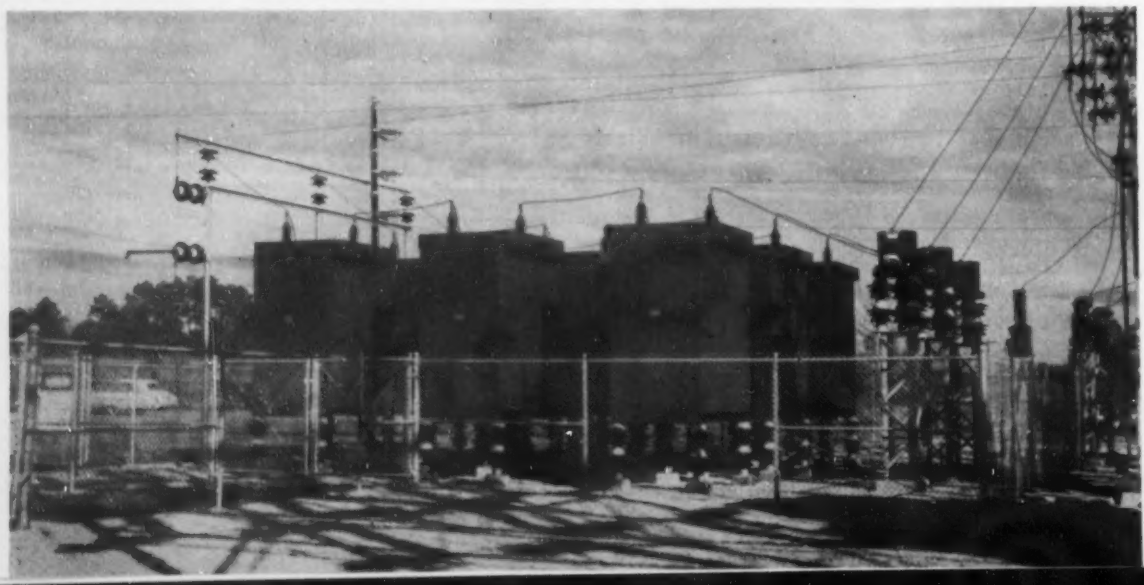
With today's rapid growth of utility load, it is not always possible or economical to plan, strengthen, and expand power systems without creating bottlenecks in the transmission system. In many such cases it is sound planning to load temporarily transmission lines well beyond their normal or surge impedance capacities in order to permit installation of larger generating units at less frequent intervals.

However, when the loading of a transmission line becomes such that I^2X loss exceeds charging kva, a lagging kilovar deficit is created which must be compensated for by some source of leading or magnetizing current, or voltage drop may become intolerable. Yet considerable dormant transmission capacity exists today, in excess of surge impedance loading of strategic lines, which may be salvaged and put to work by compensating for I^2X loss, in excess of line charging, through the use of synchronous condensers or shunt capacitors.

A typical problem illustrating this, developed on the system of the Florida Power Corp in scheduling construction of the Suwanee River steam plant. It became necessary to load a 108-mile, double-circuit tower line, connecting the Inglis steam plant and Jasper substation up to about twice its surge impedance capacity for short intervals of time over a two year period, or until the first unit of the Suwanee River steam plant, near Jasper could be placed in operation. Then the circuits could be restored to their economical loading.

The Problem . . . Twice daily, during morning and evening peaks, these circuits were called upon to deliver up to 40,000 kw into Jasper substation. Intermediate loads

CAPACITOR BANK at Jasper has metal housings and "High Q" reactor. The switching enclosure is on the far side of the HV-capacitor bank which is composed of standard 7,200-v capacitors. These units are in multiple-series for wye connection to 66-kv bus



A Southern Transmission Problem

absorbed most of the capacity in the 66-kv circuit. Thus the 110-kv circuit had to deliver 35,000 to 40,000 kw to Jasper. Because of the distance involved, particularly with new capacity being added at Suwanee River plant, another transmission line could not be justified.

An ac network analyzer study was undertaken to determine the feasibility of increasing the capacity of this 110-kv circuit by supplementing the line charging, by application of high voltage shunt capacitors. The three sets of readings in the table show the results.

Findings of Study . . . These data show that if the kvar capacity were made available at Jasper, the line could deliver substantially more than its surge impedance capacity without inflicting intolerable voltage drop. Approximately one kilowatt in dormant line capacity would be released for each kvar of static capacitors used to supplement line charging, a good return on the investment.

Obviously, the above type of operation could not be justified on this high resistance line except as a temporary expedient—or to satisfy short pronounced peak load requirements, due to excessive I^2R (kw) losses. This introduced the problem of the possibility that the capacitors might cease to be of much value in this location at some future date, particularly if Suwanee River plant capacity increased beyond 100,000 kw, which is likely.

Capacitor Selection . . . As the 110- and 66-kv buses at Jasper are connected through a 36,000-kva autotransformer (low impedance), it mattered little whether the capacitors were connected to the 110- or the 66-kv bus as far as performance was concerned. The transformer bank, being TCUL, holds very close voltage regulation on the 66-kv bus. But the 110-kv bus voltage can vary up to 20% without affecting the 66-kv level. Thus capacitors could not be applied to the 110-kv bus because of voltage variation. And, it was impractical to hold close regulation on the 110-kv bus with Jasper more than 100 miles from the nearest generation. There was no alternative but to connect them to the 66-kv bus.

There are no step down transformer banks near Jasper capable of accommodating a 6,000-kva bank of standard 7,200-v capacitors, the minimum capacity needed, according to analyzer studies. Purchase of a 6,000-kva transformer bank for use with the capacitors would also cancel 7% of the kvar of the capacitors in order to satisfy I^2X transformer losses. Consequently, Florida Power decided to eliminate transformers and build a capacitor bank of standard 7,200-v units connected in multiple-series for wye connection to the 66-kv bus.

12.4-Kv Adaptability . . . Capacity of the bank was established by use of standard 850-kva outdoor metal housings connected for operation at 14,400 v as shown. This was done so the capacitor bank could be split into nine banks for use on the 12.4-kv system should completion of the Suwanee River Plant make the installation unnecessary.

Housings may be reconnected for 3-phase operation, rated 900 kvar, 12,470 v ungrounded wye by adding one roof bushing and two 25-kvar capacitor units. Metal enclosed equipment was selected because of its portability and high salvage value. It also minimizes fuse replacements which might otherwise result from birds and foreign matter blowing into exposed live parts.

Carrier Reactor . . . To prevent the capacitor bank from attenuating several carrier current frequencies in the area, an untuned air-core "High-Q" reactor was designed. Tuned wave traps were not practical as each frequency or pair of frequencies would require separate traps. The reactor rating is 71 amp, 85 v, 60 cycles.

X_L at 60 cps = 1.2 ohms
X_L at 20 Kc = 400 ohms
X_L at 50 Kc = 1000 ohms
X_L at 70 Kc = 1400 ohms

After installation, field checks indicated that carrier attenuation losses through the reactors were negligible.

Operating Results . . . The capacitor bank has been in service on the 66-kv bus at Jasper nearly two years, and performance is as expected. Loading of the Inglis-Jasper 110-kv circuit frequently exceeds 40,000 kw without serious complaints about voltage as the capacitor installation supplies the line I^2X losses in excess of line charging and keeps the 110-kv bus voltage within range of the TCUL transformers.

The oil circuit breaker for switching the capacitor bank is equipped with discharge resistors to permit frequent switching when necessary. With wide voltage variation compensated for on the 66-kv buses by TCUL transformers, peak-off-peak switching became necessary only recently when the first Suwanee unit went into operation. Switching twice daily prevents this plant from operating at leading power factor during off-peak periods.

No condition of resonance has been encountered or detected. Maintenance has been negligible, and no capacitor fuses have blown. The installation is practically foolproof from the standpoint of inspection hazards as the neutral grounding switch is closed from the switching

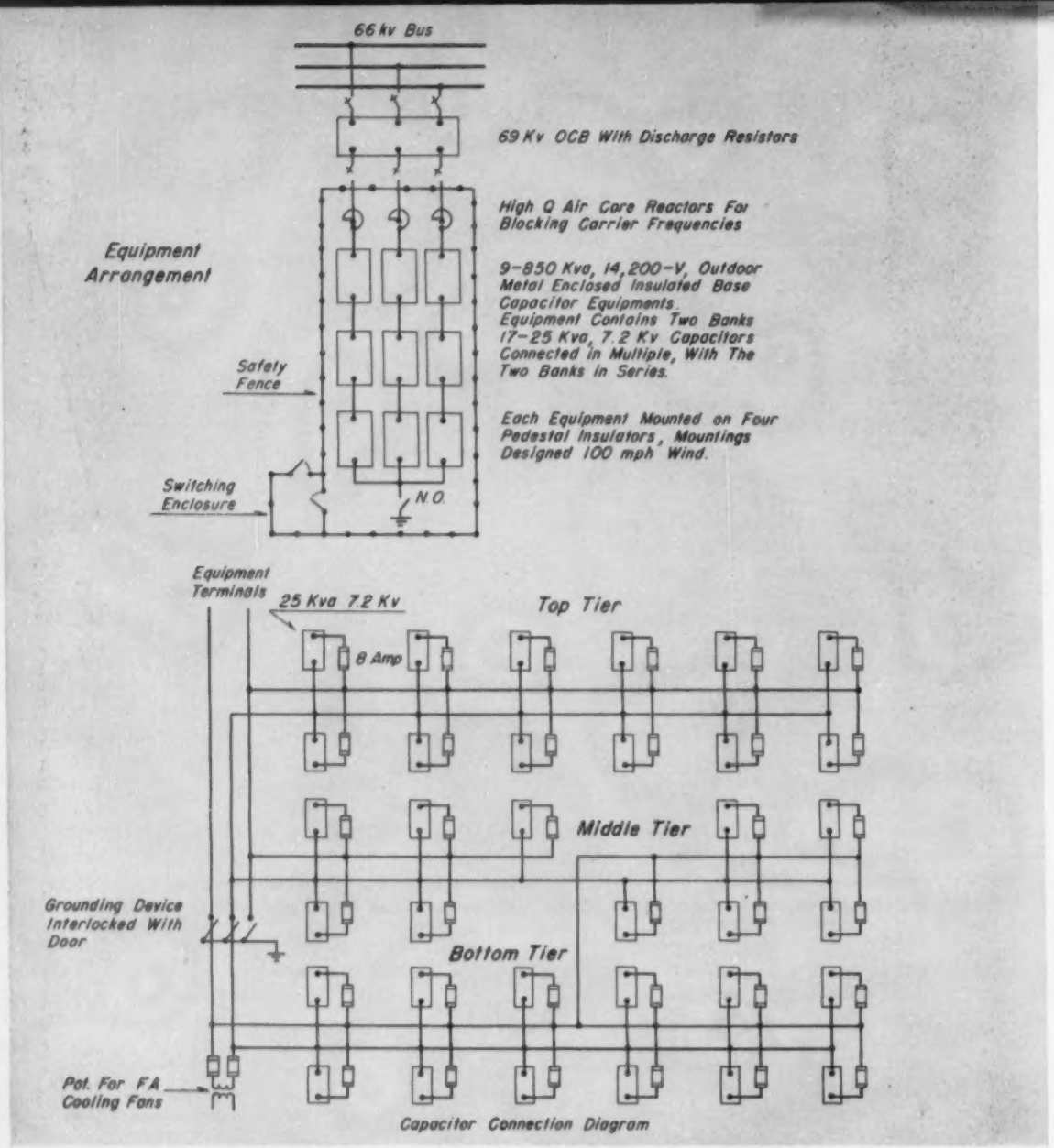
Network Analyzer Proved Plan Would Work

Inglis Terminal		Charging	I^2X Loss	Jasper Terminal		
kv	kvar	kvar	kvar	kw Rec'd	kv	kvar
117.7	− 800	6,700	7,500	28,000	98.0	0
117.0	+2,100	6,600	5,900	25,600	103.4	−1,400
117.0	+5,600	6,600	10,700	33,000	103.0	−9,700

Note: Minus (−) designates flow of leading kvar into line. The flow of kvar from Jasper to Inglis against a 14.0-kv voltage drop may appear unusual but is characteristic of this line with an R to X ratio of only .1 to 1.84.

Characteristics of the 110 and 66-kv No. 4/0 ACSR circuits:

110 kv	66 kv
R—49.70 ohms	R—49.70 ohms
X—91.25 ohms	X—91.25 ohms
Line Charging—6,900 kvar	Line Charging—2,500 kvar


66 kv Bus
69 Kv OCB With Discharge Resistors
High Q Air Core Reactors For Blocking Carrier Frequencies
Equipment Arrangement
9-850 Kva, 14,200-V, Outdoor Metal Enclosed Insulated Base Capacitor Equipments. Equipment Contains Two Banks 17-25 Kva, 7.2 Kv Capacitors Connected in Multiple, With The Two Banks in Series.
Safety Fence
Each Equipment Mounted on Four Pedestal Insulators, Mountings Designed 100 mph Wind.
Switching Enclosure
N.O.
Equipment Terminals
25 Kva 7.2 Kv
Top Tier
8 Amp
Middle Tier
Grounding Device Interlocked With Door
Bottom Tier
Pot. For FA Cooling Fans
Capacitor Connection Diagram

CAPACITOR SCHEMATIC for Jasper substation. Neutral grounding switch is closed before opening gate to capacitor enclosure

enclosure before opening the capacitor enclosure gate.

Each of the nine housings has a short circuiting and grounding switch that must be closed before the door can be opened. Before these switches are operated, the individual houses are grounded starting with the three closest to neutral and working toward the incoming line.

Two More Installations . . . The Jasper capacitor installation has been duplicated at Ocala where it has been operating over a year. A third one recently went into service.

While the problems at Ocala and Clearwater were not so critical as at Jasper, capacitors are compensating for I^2X losses in the areas satisfactorily. They also prevent serious voltage collapses in the event that a major 66-kv line fails.

Capacitor Protection . . . The series-multiple connection of units introduces a potential protection problem making it desirable to install a primary circuit breaker even if switching were unnecessary.

Six groups of 17-25-kva, 7.2-kv capacitors each are connected in series per phase. Each group has 6,420 v (67-kv bus voltage) impressed across it.

Failure of one capacitor unit in a group would increase the voltage across the 16 remaining capacitors by 5.9%. If as many as four units failed in one group, the remaining 13 would be overstressed.

This could set up a "chain" reaction and cause destruction of the entire group unless the bank was switched out of service immediately. Neither individual capacitor fuses nor 66-kv primary fuses would protect against this.

Which Station Gets the Load?

Simple curve provides adequate data for the allocation of generation to the various plants of an interconnected system

T. W. SCHROEDER, Assistant Chief Electrical Engineer, Illinois Power Co, Decatur, Ill.

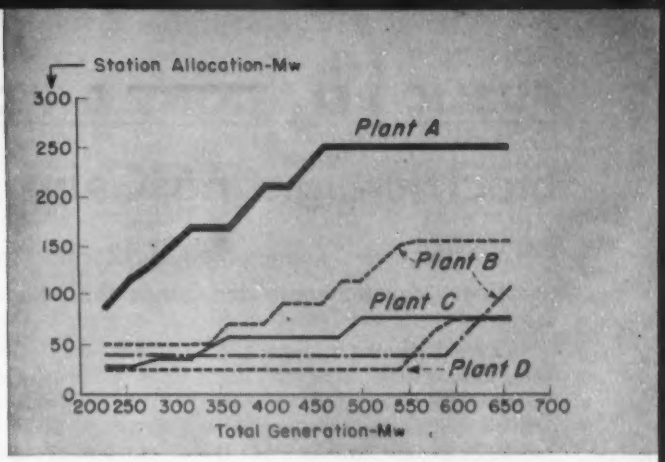


FIG 1—**PRACTICAL GENERATION ALLOCATION** curve, coordinating station generation to total generation for a station, is for operators' use

A simple, step-by-step procedure for correlating transmission losses and generation economics has been developed by the Illinois Power Co. It provides a curve for the practical allocation of generation and gives results that are sufficiently accurate for a working guide. Only a reasonable amount of network analyzer work is involved. Steps in the procedure are:

1. Set up the total interconnected systems on the network analyzer, with foreign systems or their equivalents included.

2. Set up a generating schedule in which all stations are generating at their minimum operating loading, with the system loads balanced to absorb this output and the interconnections made to give the desired net interchange with the foreign systems. Preferably, this could be the normal net interchange and could be zero.

3. Assume that the system load increases by some increment, say 25 Mw. Set up this load increase uniformly among the system loads on the analyzer. Let Station A pick up this load increase while the others remain unchanged and read the current distribution in all the major transmission lines. After restoring Station A generation to its initial value, increase Station B's load by 25 Mw and again read current distribution. Repeat this procedure until current distribution data has been obtained for each station which in turn has carried the 25 Mw increment.

4. Take the sum of the I^2R losses in the major transmission lines for each station and multiply the incremental cost of production for each plant by the sum of the load increment and the incremental transmission loss. That station producing the smallest cost of load increment and loss increment should be increased.

To illustrate, assume that the data taken and incremental costs of production are as shown in the table.

Then,

Incremental Cost/hr = $P_n (\Delta + L_n)$

Where P_n = incremental cost of production in \$/mwh for station "n".

Δ = load increment

L_n = change in total transmission loss in Mw when load increment Δ, is added to station "n".

Substituting in the above equation,

Incremental cost for Station A = \$ 76.20/hr
B = \$105.85/hr
C = \$ 63.00/hr
D = \$ 75.63/hr

As the minimum incremental cost/hr is \$63.00 for Station C, the 25 Mw increment of load should be added to Station C even though the transmission losses are less for Station D.

5. With the new generation schedule obtained, repeat steps **3** and **4** successively until all stations have been fully loaded.

6. Plot a graph of station generation vs total generation for each station for use by the operators or dispatchers. An example of such a curve is shown.

The amount of labor involved in this procedure is certainly not prohibitive, being considerably less than would be encountered in a more rigorous solution. Its results are sufficiently accurate for practical, operational purposes and should produce a useful generating schedule for the system, based on the interchange considered. It permits the evaluation of interchange with foreign systems on the basis of the determination of the change in losses occasioned by a change in net interchange value.

One advantage of this method is that bus loads can be made to vary with respect to the total system load in any way indicated by actual system conditions. This can be done by assuming that the bus loads vary in proportion to the total load, an assumption reasonably accurate for most power systems. It is not necessary to assume that the ratio of reactive power flow to real power flow is fixed. Factors such as condensers, tap changers, generator field excitation, and switched capacitor banks, all affecting the flow of reactive power, can be adjusted on the analyzer to represent actual operating conditions.

Transmission Loss and Incremental Production Cost Data for Hypothetical System

	Generating Stations			
Station increased by 25 Mw increment	A	B	C	D
Total transmission loss with 25 Mw added to each station in turn	15	14	13.5	12.5
Total transmission loss before adding 25 Mw	10	10	10	10
Total incremental transmission loss	5	4	3.5	2.5
Incremental cost of production in \$/Mwh	2.54	3.65	2.21	2.75

Electric Lighting Gains Shown

Westinghouse Lamp prepares 12 color transparencies of significant developments and lamps that made them possible

As an aid to electric utilities and others wishing to participate in Light's Diamond Jubilee, Westinghouse Lamp Division is offering an illuminated transparent-picture display of the growth of electric lighting.

The 4 by 5-ft shadowbox, which can be illuminated from behind by fluorescent lamps, contains 12 color transparencies. Each picture illustrates a significant development in electric lighting. Prominent in the foreground of each photograph is the historic lamp of the era.

The photographs were made from a series of original watercolors executed especially for this display. The original art work and the lamps pictured with them are now on display at the Ford Museum, Dearborn, Mich., where the original Edison laboratory, taken from its Menlo Park, N. J., setting, has been reconstructed as a permanent feature. The watercolors will be exhibited until next fall.

The 12 scenes are as follows:

1. Edison's 1870 laboratory at Menlo Park where the first practical incandescent lamp was made.

2. The 1893 Columbia Exposition in Chicago where George Westinghouse introduced his alternating-current stopper lamp.

3. An art gallery lighted by the Nernst lamp a brilliant white light.

4. Composing room of the old New York Post which, in 1903, installed the Cooper-Hewitt mercury tube.

5. A shopping scene illuminated by the first drawn-tungsten filament lamp in 1910.

6. A dining room setting in the 1919 era in which the initial inside-frosted lamp provided low-glare diffused lighting.

7. The Liberty Bell at the Philadelphia Sesquicentennial at which the early colored incandescents brought gayety to lighting.

8. An inside view of the Ford Building at the 1933 Century of Progress, Chicago, where high-intensity mercury lamps were first unveiled.

9. The San Francisco-Oakland Bay Bridge where sodium vapor lamps were installed in the early 1930's.

10. The Trylon and Perisphere at the New York World's Fair, 1939, where fluorescent lamps were first used.

11. A modernistic presentation of the diversity introduced into fluorescent illumination within the next ten years.

12. A view of the boardwalk at Seaside Heights, N. J., where the color-corrected mercury lamp was demonstrated.

ECAP Supplies Teaching Aids for TV Program

The first television teaching aid for the Electric Companies Advertising Program TV Show, "You Are There," has been distributed. The aid was for the show of Feb. 28, "The Rise of Adolph Hitler."

The aid supplies background information for secondary school teachers and suggests coordinated activities and reading for their students. Other aids will be prepared for these other ECAP shows:

March 14—"The Rescue of the Statue of Liberty."

March 28—"The Conspiracy of Catherine the Great."

April 11—"Paul Revere's Ride."

April 25—"The Evacuation of Corregidor."

May 9—"Capture of Mata Hari."

The Prudential Insurance Co which sponsors the program on alternate Sundays will also supply aids for these programs:

March 21—"The Surrender of Burgoyne at Saratoga."

April 4—"The Opening of King Tut's Tomb."

April 18—"The Execution of Mary, Queen of Scots."

May 2—"Death of Rasputin."

Georgia Power Co Plans Lake Recreational Area

Georgia Power Co has a plan for developing Sinclair Lake, which extends into Baldwin, Putnam, and Hancock Counties, to make it one of the state's outstanding recreational areas. County and local officials are now studying the plan.

The company proposes to set aside subdivisions for both whites and Negroes. The first area to be developed would consist of 428 lots, and all homes built on them would have to cost at least $7,500. Lots would be leased to individuals, and there would be areas set aside for a yacht club, a marina, bathing beaches, motel site, and camp sites for such groups as the Boy Scouts, Girl Scouts, and Young Men's Christian Association.

Gets Medal for TV Show

Cleveland Electric Illuminating Co has been awarded the George Washington Honor Medal of the Freedom's Foundation. The award was made to the company as the first sponsor of the television series, "I Led Three Lives." The series is the dramatized story of Herbert A. Philbrick, who served nine years as anti-Communist counterspy for the Federal Bureau of Investigation.

Ice Box Hazard Attacked

Elimination of unused ice boxes which are death traps for youngsters who hide in them is the goal of a campaign just started by Telluride Power Co. Meter readers have been asked to report any such boxes they see. The company will then notify the owner and ask him to destroy the box or else make it safe by removing the door latches.

More Entries Than Ever

Carolina Power & Light Co's 1954 "Finer Carolina" contest has drawn 164 entries. The previous record was 148 for the 1952 contest. The company is offering $6,750 in prizes to winning towns, divided into three population groups.

WASHINGTON COMMENT

JESSE MOCK

Underneath the political smoke, the controversy over the government proposals for selling power in Georgia comes down to just one issue:

Does the tri-contract proposal for disposing of Clark Hill power deprive preference customers of title to the power which they claim is theirs?

Preference and the Clark Hill power contracts

It is this issue—title to the power—that catapults the Georgia marketing proposal into the national limelight as a significant shift in federal power policy. It is the issue which has public power advocates biting their fingernails.

Under law, Interior Department is directed to market power from such dams as Clark Hill in a manner to encourage the most widespread use at the lowest possible rates consistent with sound business principles. More to the point in the title issue, the law also requires Interior to give preference to public bodies and cooperatives for the purchase of such power.

Three Contracts, One Issue . . . Interior Solicitor Clarence A. Davis is fully convinced that the recently announced tri-contract proposal for Georgia meets all those standards. Briefly the proposal is this:

Under a basic contract, Interior agrees to sell the complete Georgia share of Clark Hill firm power to Georgia Power Co for delivery to preference customers in quantities and at rates specified in the contract.

In a second contract, between the government and preference customers, the government guarantees that specified amounts of firm power will be delivered to designated customers at the going Clark Hill rate. Total amount of power committed under this contract will be equivalent or possibly in excess of the amount of firm power sold to Georgia Power under the basic contract.

Third contract, this one between Georgia Power and preference customers, is an agreement to serve the customers all the power they need in excess of that which they will get under the government and basic contracts.

It is clear at first blush that preference customers would not get the clear and direct—practically unlimited title—to federal power available to them under the "wheeling" contracts now in effect in other areas. More important, the government does not undertake to supply all the power needs of preference customers in the Clark Hill area.

No Federal Competition . . . In other words, federal power is not to be used to upset the traditional power marketing pattern long established in Georgia. Federal power would come into the area to supplement current sources—not to compete with them.

It is just this situation that upsets the public power advocates. In many areas they have used the cheap federal power to cut into the service areas of electric companies. Low-priced federal power has been the basic ingredient of the public power crusade.

In the Georgia case, co-op spokesmen have argued that if they could get title to the Clark Hill power at the bus bar, they could then use it as a lever to maintain or improve their rate structure.

Preference customers can't kick up much of a fuss over the rates offered in the Interior proposal. They would receive power at about 6.28 mills per kwhr at their load centers. That's the postage-stamp rate for Clark Hill power. This is well below the cost under a typical wheeling contract. It is also only a fraction under the 6.67 mills rate of Georgia power.

Further, Interior feels it would be hard to find a more equitable method for distributing Clark Hill power among all the preference customers in Georgia.

But preference customer lawyers profess to worry that the second contract—between the government and preference customers—is really only an appendix of the basic contract. They argue that the whole proposal circumvents the preference clause because a private company is really given first crack at buying federally produced power.

Public power advocates are scared that it will set a precedent which would prevent them from getting direct access to federal power in other areas where they could use it to further their cause.

The question remaining is whether preference customers are being deprived of rights that are legally theirs—or merely of advantages and privileges accorded them by previous administrations.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Beryllium is lighter than aluminum, is strong, has good corrosion resistance to air and water and has a high melting point, but it is brittle and expensive.

Fluorescent lamp life is longer at higher frequencies because they start quicker and at lower voltages.

Dispatching terminology is definitely not standardized. Safety lags as long as that situation persists.

Demand factor for station auxiliary load can be taken as 65% to 75%. The margin is something to draw upon in emergency when the source is curtailed.

Electrode composition to achieve 1 to 4% ferrite-bearing weld deposits for high temperature piping should be balanced toward this objective as well as to carry 0.6 to 0.9% columbium for retention of high temperature strength.

Corrosion of metals in many soils is attributed chiefly to differences in accessibility of oxygen to the metal surface. Currents flow from oxygen-deficient areas to areas receiving more oxygen.

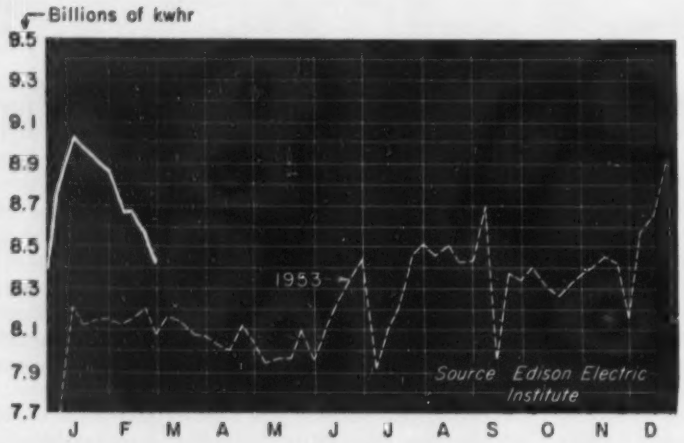
Competitors calling you "crazy" afford much better protection than a patent (C. F. Kettering).

Speed regulation on the hydro turbine driving an induction generator is not necessary as the system speed governs.

Total connected full load kva rating of auxiliary motors in a large plant will be about 9%. Water treating, coal handling, and ash disposal will comprise 2% or less of this 9%.

Contingencies feared by "iffy" operators have to be discounted somewhat because controls to deal with unlikely simultaneous occurrence would be too complicated and expensive.

STATISTICS



Output Week Ended Feb. 27—8,396,000,000 Kwhr

Seasonally Adjusted Index†—157.6

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Feb. 27	+4.0	+2.0	+0.8	—2.0	+7.5	+15.5	+9.0	+2.8	+7.2	—3.5
Feb. 20	+4.3	+3.7	+1.0	—2.9	+5.6	+15.0	+9.5	+2.5	+9.8	+1.8
Feb. 13	+6.6	+5.9	+2.8	—1.2	+7.3	+19.3	+6.6	+6.2	+13.2	+5.4

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Dec.	81.2	78.1	75.5
Capacity (Million Kw)	Dec.	91.49	89.81	82.05
Production (Billion Kwhr)	Dec.	39.06	36.38	36.45
Hydro	Dec.	8.67	6.91	8.22
Fuel	Dec.	30.39	29.47	28.23
Fuel Consumption				
Coal (Million Tons)	Dec.	10.87	10.17	10.75
Oil (Million Barrels)	Dec.	7.62	6.91	8.60
Gas (Billion Cu Ft)	Dec.	70.78	81.13	59.81
Sales (Billion Kwhr)	Nov.	31.59	32.21	30.08
Residential	Nov.	9.02	8.70	8.16
Commercial	Nov.	5.50	5.62	5.01
Industrial	Nov.	14.95	15.56	14.91
Other	Nov.	2.12	2.33	2.01
Net Income Class A & B Companies ($ Million)	Nov.	84.26**	76.19	80.63
Estimated Dec. '54 Peak (Million Kw)	Nov.	94.7	94.8	96.1
Kwhr per Residential Customer (12 Month Average)	Nov.	2,331	2,318	2,155
Revenue per Kwhr Residential Service (12 Month Average)	Nov.	2.75¢	2.75¢	2.77¢
Canadian Production (Billion Kwhr)	Dec.	5.72	5.45	5.54

Business Statistics

FRB Industrial Production Index†	Jan.	124	125	132
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	369.0	372.4	345.3
EW 4 Industry Production Index†	Jan.	118.5	120.4	125.3
ENR Construction Cost Index††	Feb.	128.9	128.7	123.1
BLS Consumer's Price Index	Dec.	114.9	115.0	114.1
NEMA Insulation Materials Sales Index†	Dec.	133	130	176
NEMA Electric Appliance Sales Index†	Dec.	69	70	105
NEMA Household Refrig. Sales Index†	Dec.	53	35	75
Metal Prices (Mar. 2)				
Copper, Conn. V., lb		$.29½-.30	.29½-.30	.29½-.30
Lead, N. Y., lb		.12½	.13	.13½
Zinc, prime Western E. St. Louis, lb		.09¼	.09½	.11¼
Tin, Straits, qual. N. Y. lb		.86¾	.85	1.21½
Aluminum, ingot, base price		.21½	.21½	.20½
Nickel, base price		.60	.60	.60
Steel, billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		28.00	30.00	45.00

*Preliminary **Revised †1947-49=100 ††1949=100

A UN 'Progress' Report: Population & Production

The theme is progress and the variations seemingly endless in the United Nations Statistical Yearbook for 1953, just published. Putting aside for the moment the varied grim-looked or sanguine views of the present and future, it is pleasant to look at the last two decades in which the world of today has made some measurable advances.

Two phases of growth, perhaps the first that come to mind, are in population and production. In terms of the people themselves, the growth of the world has been from a range of 1,753 to 1,872 million in 1920 to a range of 2,405 to 2,533 million by mid-1952. When you compare this to the land area, this averages to approximately 18 persons per square kilometer.

World Production*
(000 metric tons)

	1937	1952
Wheat†	128,800	164,600
Raw Cotton†	5,970	6,890
Wool†	1,612	1,805
Rayon	827	1,626
Coal	1,154,000	1,211,000
Petroleum	256,300	576,400
Electric Energy (million Kwhr)	406,700	1,022,400
Steel (crude)	117,500	175,000
Aluminum	450	1,800
Cement	75,900	142,900
Newsprint	7,910	9,260
Motor vehicles (000 units)	6,195	7,845

* Excluding USSR
† Average agricultural years

In terms of industrial production, the percentage increase during the two decades ending in 1952 amounted to 189%. Production of electric energy advanced by 294%, petroleum by 229%, crude steel by 186%, motor vehicles by 199% and coal by 34%, to mention the more important sectors of productivity.

The U. S. role in these compilations is no mean one. Of the 1952 world, with the exception of Russia, the UN yearbook records the following percentages as the U. S. share of total production in each category: wheat—21%; cotton — 48%; wool — 6%; rayon—32%; coal—37%; crude petroleum — 54%; electric energy — 45%; steel—48%; aluminum—63%; cement—30%; newsprint—11%; and most significantly, motor vehicles—75%.

FINANCIAL

Security Sales to Public Hit Record in 1953

Investor-owned electric utilities sold nearly $2 billion securities to investors

Security sales to the public by the investor-owned electric utilities hit a record high in 1953, Reis & Chandler, Inc, said recently when it released the figures shown in the tabulation on this page.

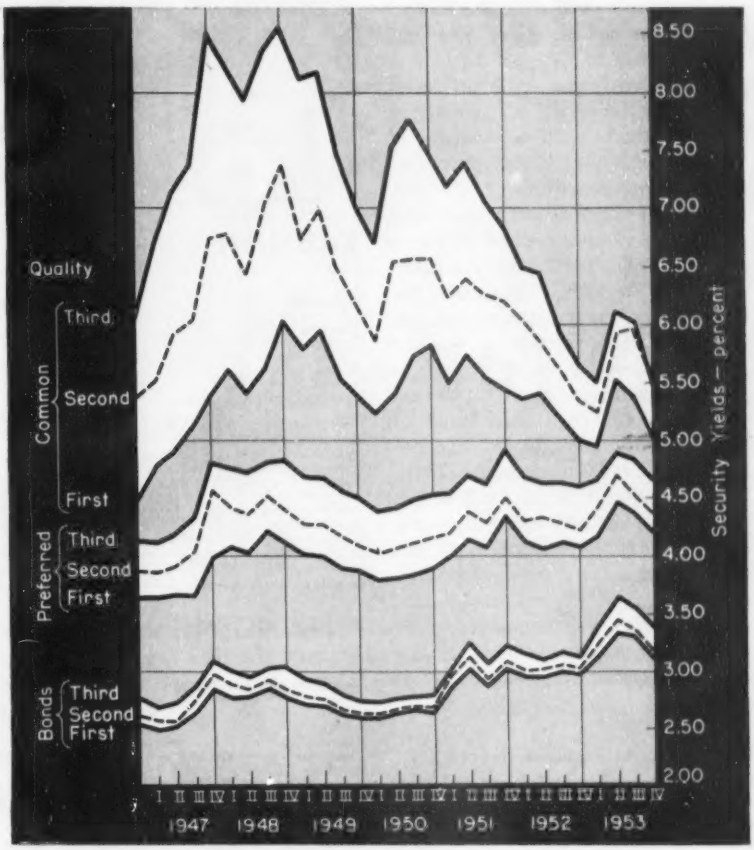
Investors put in almost 70%, or nearly $2 billion towards the record $2.9 billion these companies spent for construction in 1953.

Private Sales Higher . . . Bonds issued and delivered to institutional investors in 1953 came close to $195 million as compared with $163 millon in 1952. Preferred stock sales to these investors amounted to $51 million as compared with $12 million in 1952. These figures do not include securities sold for refunding purposes.

In addition, private investors made commitments to purchase a total of $420 million in debt securities from the Ohio Valley Electric Corp. They also agreed to buy $30 million bonds from Electric Energy, Inc, besides a commitment of $65 million made in the year of 1952.

The OVEC financing program became the largest ever to win approval of the Securities and Exchange Commission. In addition the 15 sponsoring companies will supply $20 million of equity capital. Part of the securities have been delivered with the balance to be transferred over the next two years. Commitments of this type outstanding at the end of the year totaled $480 million.

Bond Yields Fluctuated Widely . . . Year 1953 will be remembered as one characterized by a wide range of fluctuations in money rates and bond yields. Reis & Chandler's first quality bond yield index rose from 3.00% at the beginning of 1953 to 3.37% by the middle of May, around which level it fluctuated until the middle of June, then falling irregularly to 3.30% at the end of September. During the last quarter the decline in yields was more pronounced and by the end of



Public Offerings—Electric Utility Securities
(Thousands of Dollars)

	1953			1952		
	New Money	Other	Total	New Money	Other	Total
Bonds, Notes, and Debentures	962,200	2,000	964,200	920,043	.....	920,043
Preferred Stocks	169,437	6,642	176,079	189,875	.....	189,875
Common Stocks (a)	533,166	5,560	538,726	421,920	13,570	435,490
Total	**1,664,803**	**14,202**	**1,679,005**	**1,531,838**	**13,570**	**1,545,408**
	First Quarter			**First Quarter**		
Bonds, Notes, and Debentures	199,800	2,000	201,800	295,800	.....	295,800
Preferred Stocks	70,717	.....	70,717	60,983	.....	60,983
Common Stocks (a)	166,092	.....	166,092	80,347	5,601	85,948
Total	**436,609**	**2,000**	**438,609**	**437,130**	**5,601**	**442,731**
	Second Quarter			**Second Quarter**		
Bonds, Notes, and Debentures	343,400	.....	343,400	341,759	.....	341,759
Preferred Stocks	71,275	6,642	77,917	46,885	.....	46,885
Common Stocks (a)	163,017	.....	163,017	249,239	.....	249,239
Total	**577,692**	**6,642**	**584,334**	**637,883**	.....	**637,883**
	Third Quarter			**Third Quarter**		
Bonds, Notes, and Debentures	205,500	.....	205,500	134,000	.....	134,000
Preferred Stocks	2,000	.....	2,000	46,180	.....	46,180
Common Stocks (a)	114,217	2,237	116,454	44,663	.....	44,663
Total	**321,717**	**2,237**	**323,954**	**224,843**	.....	**224,843**
	Fourth Quarter			**Fourth Quarter**		
Bonds, Notes, and Debentures	213,500	.....	213,500	148,484	.....	148,484
Preferred Stocks	25,445	.....	25,445	35,827	.....	35,827
Common Stocks	89,840	3,323	93,163	47,671	7,969	55,640
Total	**328,785**	**3,323**	**332,108**	**231,982**	**7,969**	**239,951**

Source: Reis & Chandler, Inc.
Notes—Bonds are shown at principal amount and stocks at the price to the public. (a) Offerings to stockholders under subscription rights are included in same quarter as the date of stock record.

the year, the index stood at 3.07%.

In May the Federal Reserve Board did step in to take control and since that time has maintained the market in a condition of ease. Funds for investment have been further augmented by the decline in normal business borrowings and since the turn of the year the fall in interest rates has been accentuated.

There were some 25 bond issues sold during late spring and summer of last year which could be refunded at lower interest cost under prevailing money market conditions.

Last year common stock sales were 28% of all securities issued excluding sales by OVEC and EEInc, compared with 25% in 1952. Of course, the total additions to common equity, also include retained earnings, so that the industry's common equity ratio was probably unchanged or higher than it was in 1952. When an offering of common stock made to employees is separate from that made to the public, it is not included in the totals below.

The utility industry is forced to seek outside funds to finance expansion programs to a far greater extent than other corporate organizations. Last year manufacturing corporations, for instance, financed only 12% of the capital expenditures through new securities sales.

D-J Utility Averages at Record . . . Despite the continuing volume of new electric utility common shares coming upon the market, the Dow-Jones utility averages have been going up since 1948 and last March reached 53.88, the highest point since 1931. This level has been exceeded in 1954. Average yield obtained at current prices of 134 electric utility shares is about 5½%. The attractive return and the growing preference for electric utility equity securities, especially by the institutional type investor, are factors in back of the favorable market for equity shares. Furthermore a recent study showed that there will be a considerable surplus of funds seeking investment in 1954.

Puget Sound P&L's Net Income Up 24% in 1953

Puget Sound Power & Light Co's preliminary net income last year increased 24% over the previous year,

(*Continued on page* 183)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1954									
Feb. 25	**2.85**	**2.90**	**3.17**	**3.94**	**4.11**	**4.49**	**4.87**	**5.29**	**5.39**
Feb. 18	2.89	2.95	3.19	3.97	4.12	4.48	4.89	5.31	5.41
END OF QTR.									
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50

Data: Reis & Chandler, Inc.

EARNINGS

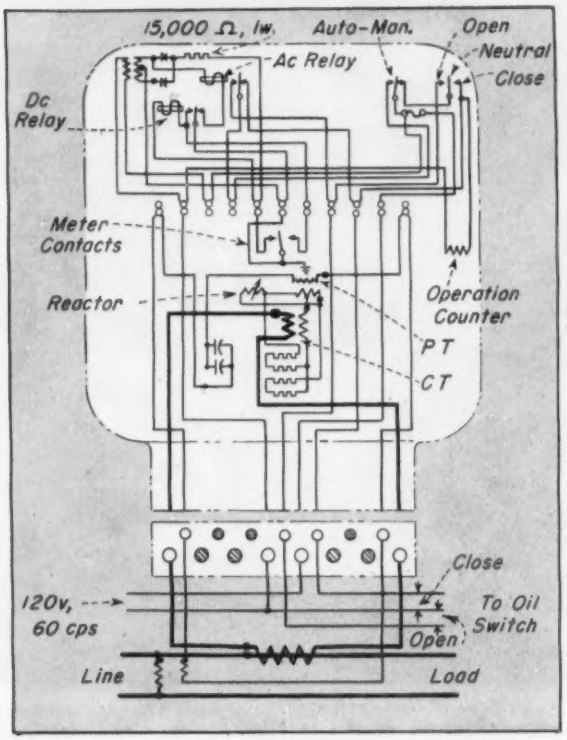
Company	Period Months Ended		Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Alabama Power	12	Jan.	$13,236,954	$11,670,336	$....	$....
Carolina Power & Light	12	Jan.	7,320,704	7,217,575	....	....
Central Illinois Light	12	Jan.	3,276,407	3,061,828	2.77(a)	2.84(a)
Detroit Edison	12	Jan.	20,671,852	17,651,191	1.96(b)	1.80(b)
Georgia Power	12	Jan.	12,707,404	12,193,165	....	....
Houston Lighting & Power	12	Jan.	10,412,302	9,011,374	1.90(b)	1.81(b)
Iowa Southern Utilities	12	Jan.	1,320,806	1,134,639	1.61(e)	1.62(e)
Minnesota Power & Light	12	Jan.	4,041,251	3,411,837	2.0 (f)	1.65(f)
New York State Electric & Gas	12	Jan.	9,170,043	7,585,197	2.55(g)	2.42(g)
Southern Co. consolidated	12	Jan.	22,532,435	20,515,312	1.24(i)	1.20(i)
Southern Indiana Gas & Electric	12	Jan.	2,178,191	1,906,884	2.21(j)	2.18(j)

Notes—(a) Based on 1,000,000 shares in 1954 and 900,000 in 1953; (b) Based on shares outstanding at close of respective periods; (e) Based on 736,880 shares in 1954 and 589,911 in 1953; (f) Based on 1,716,094 shares outstanding in 1954; (g) Based on 3,034,068 shares in 1954 and 2,696,95? shares in 1953; (h) Based on the average number of shares outstanding; (i) Based on 18,087,643 shares in 1954 and 17,082,230 shares in 1953; and (j) Based on 799,167 shares in 1954 and 685,000 shares in 1953.

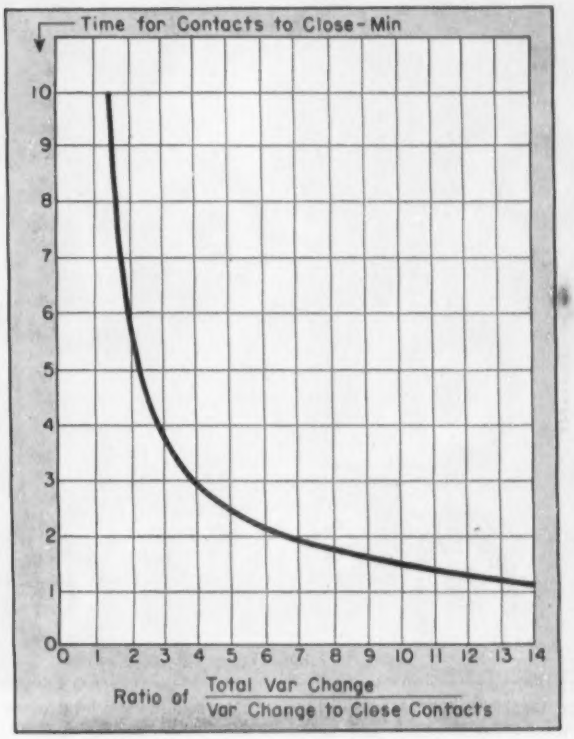
FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF FEBRUARY 25 TO MARCH 3			
Bonds			
Houston Lighting & Power—1st mtg 3% due 1989	$30,000	102.189%	2.90%
Tacoma, Wash.—light and power revenues due 1964–79	5,000	various	1.95-2.60
Suburban Electric—1st mtg 3½% due 1984	4,000	102.46	3.00
Preferred Stock			
Long Island Lighting—70,000 sh 4.25% $100 par	$7,000	$100.00	4.25%
Common Stock			
Southern California Edison—600,000 sh	$24,150	$40.25	4.97%
California Oregon Power—300,000 sh	7,950	26.50	6.04%
SCHEDULE FOR MARCH—APRIL—MAY			
Bonds			**Bid Date**
Omaha Public Power District—electric revenues due 1956–84	$12,000	.....	Mar. 9
California Oregon Power—1st mtg due 1984	10,000	.....	Mar. 9
Alabama Power—1st mtg due 1984	17,000	.....	Mar. 16
El Paso Electric—1st mtg due 1984	5,000	.....	Mar. 16
Pennsylvania Electric—1st mtg	12,000	.....	Mar. 17
Pacific Power & Light—1st mtg due 1984	8,000	.....	Mar. 29
San Diego Gas & Electric—1st mtg due 1984	17,000	.....	Mar. 30
Georgia Power—1st mtg due 1984	11,000	.....	April 6
Community Public Service—1st mtg due 1984	3,000	.....	April 6
Southern Indiana Gas & Electric—1st mtg due 1984	8,000	.....	April 13
Ohio Power—1st mtg	20,000	.....	April 14
Los Angeles Department of Water & Power—electric plant revenues due 1955–84	15,000	.....	April 14
West Penn Power—1st mtg due 1984	12,000	.....	April 20
Utah Power & Light—1st mtg due 1984	15,000	.....	May 19
New York State Electric & Gas—1st mtg	20,000	.....	.....
Preferred Stocks			
El Paso Electric—15,000 sh no par	$1,500	.....	Mar. 16
Louisiana Power & Light—70,000 sh $100 par	7,000	.....	Mar. 23
Dallas Power & Light—70,000 sh no par	7,000	.....	Mar. 24
Northern States Power (Minn.)—150,000 sh $100 par	15,000	.....	April 14
Ohio Power—50,000 sh $100 par	5,000	.....	April 14
Arkansas Power & Light—70,000 sh $100 par	7,000	.....	April 20
Rochester Gas & Electric—50,000 sh $100 par	5,000	.....	.....
New York State Electric & Gas—50,000 sh	5,000	.....	.....
Common Stocks			
Wisconsin Public Service—316,867 sh (to be offered commonholders on 1-for-7 basis, record about Mar. 12 to expire Mar. 30; employees will get right to subscribe up to 10,000 shares of unsubscribed shares)	.....	.....	.....(a)
Utah Power & Light—200,000 sh	.....	.....	Mar. 23
Southern Indiana Gas & Electric—114,166 sh (to be offered commonholders on a 1-for-7 basis, record about Mar. 24 to expire April 9)	.....	.....	.....
Texas Utilities—250,000 sh	.....	.....	April 13
Northern States Power (Minn.)—1,219,864 sh (to be offered commonholders on 1-for-10 basis)	.....	.....	.....

Notes—(a) First Boston Corp—Merrill Lynch, Pierce, Fenner & Beane—Robert W. Baird & Co—William Blair & Co, underwriters.



CAPACITOR SWITCHING CONTROLS similar to this var control have been developed for other quantities—amperes, watts, volts



INVERSE TIME CURVE for a var control shows that response is rapid for large electrical changes and slower for the smaller changes

Thermal Meters Control Capacitor Switching

JAMES H. PATTON, Vice President, Sangamo Electric Co, Springfield, Ill.

Controls are under development by Sangamo Electric Co for switching capacitors as a function of electrical quantities, such as volts, watts, vars, and amperes. A desirable time delay for electrical quantity changes results from use of a thermal demand meter in conjunction with relays.

Controls consist of a standard Lincoln thermal meter of the proper type depending on the electrical quantity involved. The meter's pointer serves as a demand indicator and as a blade of a single-pole, double-throw switch. Two "fixed" contacts of the switch, between which the pointer operates, are adjustable and settings are indicated on the meter scale.

A three-wire circuit from the switch controls a pilot relay. This in turn operates the single-pole, double-throw, main relay that controls the oil switch actuating mechanism for energizing capacitors. Other switches are provided to override the automatic control.

In operation of a var control, the pointer travels upward as the lagging reactive load increases and closes on the upper fixed contact. This in turn closes the pilot relay circuit, which locks in to prevent chattering; releases the coil of the main relay; energizes the "close" oil switch control mechanism; and connects the capacitors to the line.

When reactive load reduces, the pointer falls away from the upper contact. No action is initiated because the pilot relay is locked in until the pointer contacts the lower fixed contact. When this happens, the pilot relay releases and energizes the main relay. This closes the "open" control circuit of the oil switch disconnecting the capacitor.

The var control has a raised zero, so that the useful range of the instrument includes leading as well as lagging power factor.

Operation of other controls is similar to that described except in the case of the voltmeter. Here, the meter contact functions are reversed so that capacitors are removed from the line when the meter's pointer closes the upper contact.

The control's characteristic is identical to other Lincoln instruments and results in an inverse time curve. In the curve shown for a var control time for pointer contacts to close after a var change is plotted against the ratio of the total change to the change required to operate contacts.

(*Continued on page* 107)

ONLY UNDER DIRECT FLAME, will GE's new self-extinguishing insulation for metal-clad switchgear char—as demonstrated in this picture with flame of blow-torch applied directly to the new laminated sheet-type insulation.

General Electric "Self-X" insulation gives

New sheet-type material with exclusive, flame-retardant feature localizes damage that may occur under abnormal conditions

The equivalent of a "built-in fire extinguisher"—a flame-retardant insulation for switchgear, marks the most recent General Electric development for even safer, more dependable metal-clad switchgear—industry's standard for 2400- to 13,800-volt circuits.

In introducing this flame-retardant insulation—which was perfected by Nicholas F. Arone, engineer in its Switchgear Department in Philadelphia—G.E. has gone far to minimize all potential fire hazards in switchgear.

All good insulating material has three standard properties: high mechanical strength, high dielectric strength, and a non-hygroscopic quality. To this group, G.E. is the first to add an important fourth property: a self-extinguishing characteristic that *refuses to sustain combustion.*

The laminated insulation sheet will burn and char—but *only* if an outside source of flame remains in contact with the sheet itself. Once the source is removed, polyvinylchlorides "smother" the flame in less than a minute—localize damage—and permit quick access to compartments for inspection and maintenance.

In bus and cable supports, in insulating barriers between compartments, in box barriers for arc chutes—throughout vital spots of metal-clad, GE's new flame-retardant insulation works for greater protection under *all* conditions—without extra cost to you.

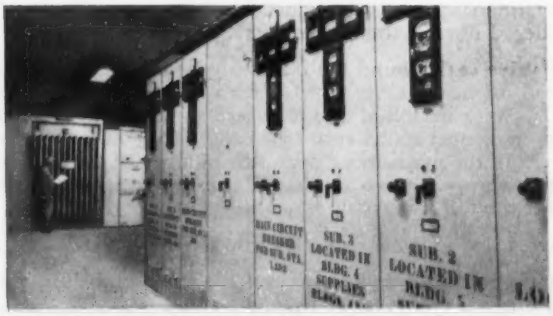
G. E. BURENS, *general manager, Switchgear and Control Division, presents Coffin Award to N. F. Arone for development of outstanding new insulation. Coffin Award is General Electric's highest employee honor.*

For information on improved Metal-Clad Switchgear, with new, flame-retardant insulation, call your nearest G-E sales representative, or write to General Electric Company, Schenectady 5, N. Y. 8743

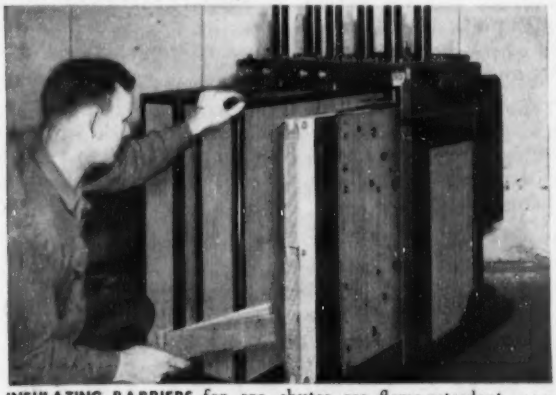
GENERAL ELECTRIC

WITH FLAME REMOVED, the flame-retardant insulation refuses to sustain combustion—and extinguishes itself in less than 60 seconds. Polyvinyl-chlorides in the laminated sheet "smother" the flame, permitting ready access to compartments for inspection and maintenance.

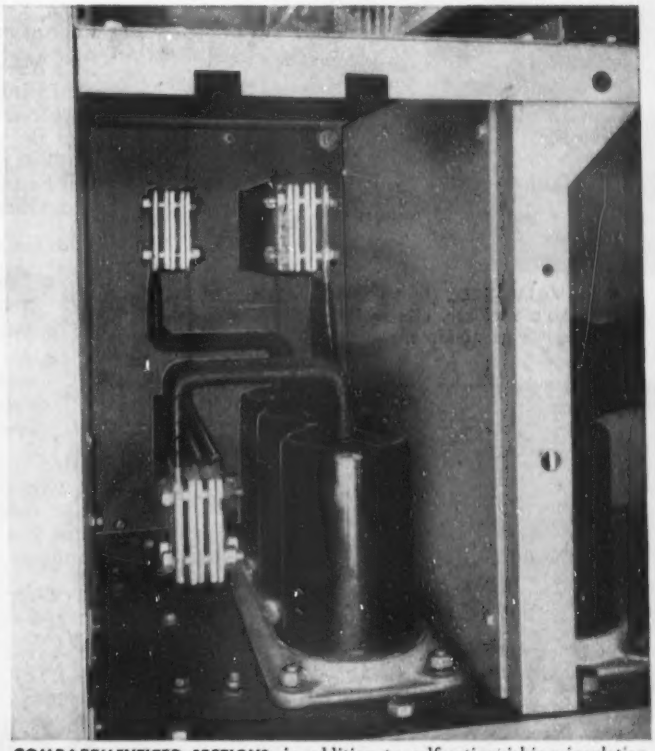
added protection to metal-clad switchgear



THIS METAL-CLAD SWITCHGEAR lineup features GE's new flame-retardant insulation at vital points throughout all sections.

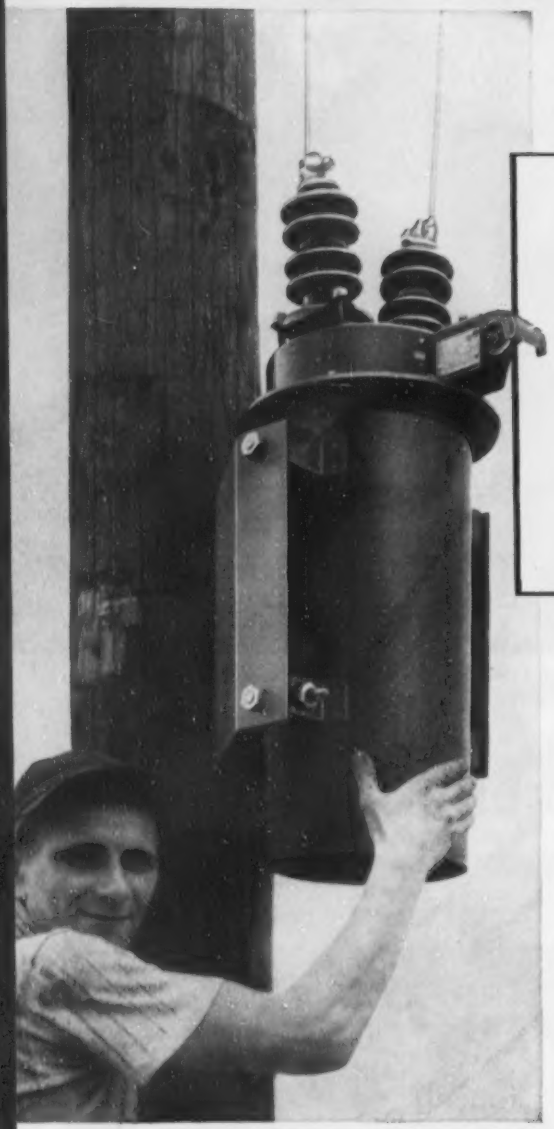


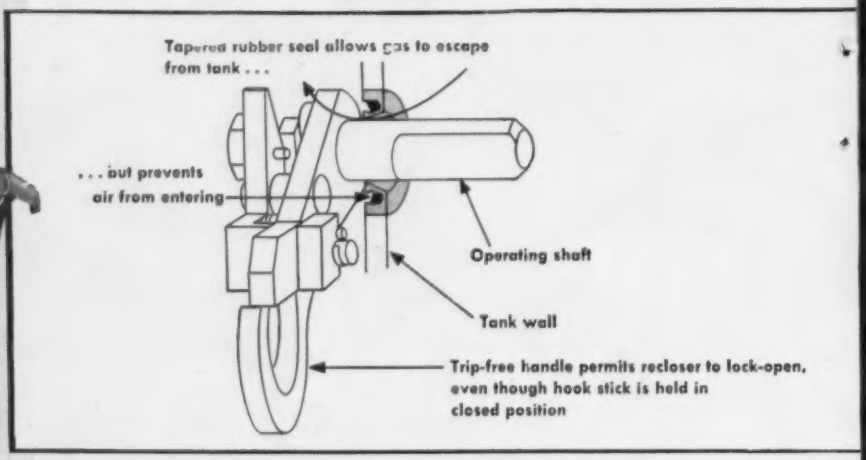
INSULATING BARRIERS for arc chutes are flame-retardant, non-hygroscopic, possess high mechanical and dielectric strength.



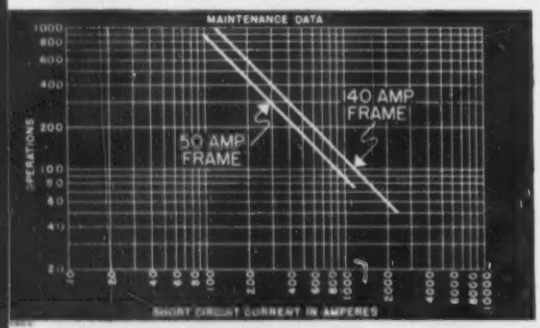
COMPARTMENTIZED SECTIONS, in addition to self-extinguishing insulation as shown in this bus section, limit damage from abnormal conditions.

"No more recloser maintenance for another 3 years!"




Tapered rubber seal allows gas to escape from tank . . .
. . . but prevents air from entering
Operating shaft
Tank wall
Trip-free handle permits recloser to lock-open, even though hook stick is held in closed position

G-E's VALVE SEAL (in diagram) keeps dust, moisture from recloser, allows interruption gases to escape. Recloser maintenance is reduced two-thirds.



SUGGESTED GUIDE for number of recloser operations before inspection of 50- or 140-amp unit is based on conservative laboratory tests. With experience, time interval of 3 years may be extended later.

G-E exclusive "Sealed Unit" on Type FR Automatic Recloser permits longer inspection intervals

For the first time in the history of oil circuit reclosers, it is now possible—with General Electric's exclusive sealed unit Type FR Recloser—to schedule inspection and maintenance *only every 3 years.* Your maintenance is thus reduced to about one-third the amount considered normal for all reclosers.

GE's one-way valve seal around the operating handle shaft allows use of inhibited oil now being shipped with reclosers up to 140 amp frame size. With inhibited oil, reclosers should be inspected after the number of operations recommended on the curve in the graph at the left. In the majority of cases, the number of operations will be less than shown on the graph, and the recloser can be left in operation for the full 3 years.

With GE's new sealed unit FR reclosers, you get—

- **Exclusive valve seal that keeps out moisture and dust, yet permits interruption gases to escape.**
- **Minimum maintenance—reduced two-thirds.**
- **An available recloser design, completely interchangeable with other makes—plus top G-E quality and materials developed over a half century of manufacturing high-voltage breakers and reclosing devices.**

Sealed unit Type FR Automatic Reclosers come in single-phase FR-1 model and three-phase FR-3, continuous current of 5 to 140 amps, interrupting capacity of 125 to 2500 amps at 2400 to 14,400 volts. For details, write for bulletin, GEA-5961. General Electric Company, Schenectady 5, N. Y. 872-7

You can put your confidence in—

GENERAL ELECTRIC

Thermal Meters

(*Continued from page* 103)

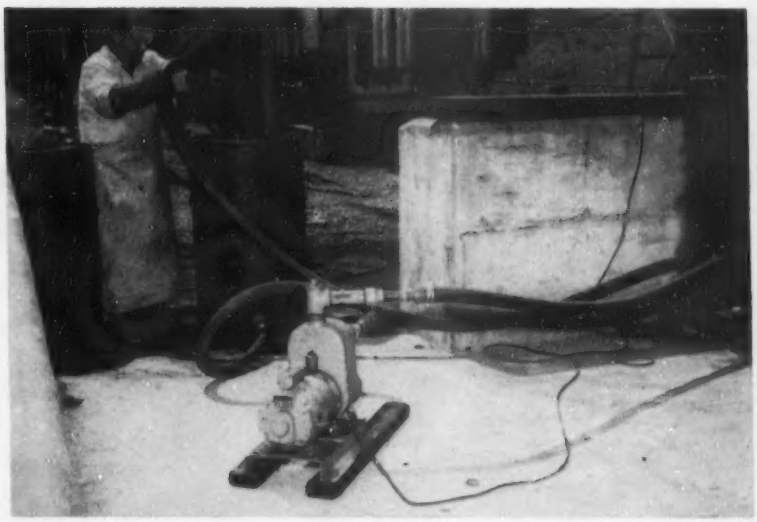
When the new load is slightly in excess of the contact setting, the control responds slowly to changes. But when the new load greatly exceeds the contact setting, the action is more rapid. Controls are thus able to distinguish between large changes that require fast action and small changes that might result in an excessive number of oil switch operations if a time delay were not incorporated.

Portable Equipment Acid Cleans Coolers

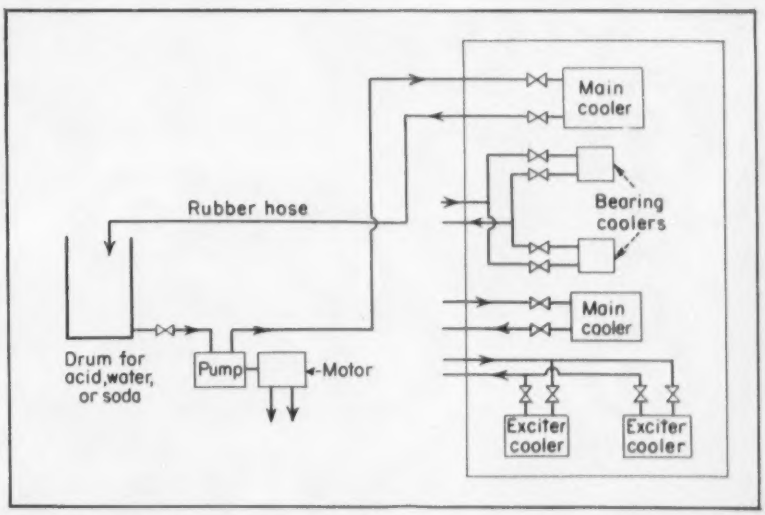
J. G. TAPLEY, System Substation Engineer, Appalachian Electric Power Co, Roanoke, Va.

A simple acid-cleaning outfit has been devised for the cooling coils of synchronous condensers having connections for acid cleaning. It can be moved easily to various locations because of the small pump and small quantity of acid required with recirculation. Excessive foaming and a mess around machine, present with some types of systems, are avoided or reduced.

Outfit consists of two 55-gal drums (one containing acid solution, the other for clear water or mixing and circulating soda solution), a 40-gpm pump driven by a ½-hp, 115-v, 1725-rpm motor, and three, 1½-in., heavy-duty, rubber hoses. One 4-ft hose section connects intake side of pump to nipple near bottom of acid drum, and two 35-ft sections are for recirculating connections between the pump discharge, cooler system, and top of acid drum. The tops were cut out of both drums which have 1.5-in. gate valves in 1.5 x 4-in. nipples near the bottom. The hoses have unfinished cast-brass couplings.



ACID-CLEANING OUTFIT consists of motor-driven 40 gpm pump and two 55-gal drums for cleaning synchronous condenser coolers



FLOW DIAGRAM shows connections of acid-cleaning outfit to main, bearing, and exciter coolers. Muriatic acid is used for cleaning and soda for neutralizing

Cleaning and Neutralizing . . . Initially an inhibited muriatic-acid solution containing three parts water and one part acid was used for cleaning but it was too weak. Experiments indicate that a 1.5:1 solution does an excellent job for the average amount of sludge and scale, whereas a 1:1 solution is necessary where considerable scale is encountered. All solutions have one quart of NEP22 inhibitor added for each 13 gal of muriatic acid.

When cleaning, the outfit is connected as shown in the flow diagram and acid solution is circulated for one hour. Cooler section is then flushed clean with clear water. After discharge appears clear, water flushing is continued for about one hour to remove all contamination loosened by the acid. Soda solution (10 lb soda ash to 55 gal of water) is then flushed through cooling coils to assure full neutralization of the acid remaining in the coolers.

During the cleaning process the cooler vents are opened to prevent gas blanketing. A strainer basket at the discharge end of the recirculation hose is helpful in preventing dislodged but undissolved scale particles from recirculating.

Handy lifting hook can be used to hoist G-E capacitors without danger to seal. Installation is easier, faster and safer.

MOUNT IN ANY POSITION

Complete air evacuation assures high dielectric strength

GENERAL ELECTRIC CAPACITORS CAN BE LIFTED BY THE BUSHINGS

Cast-glass bushings are welded and soldered directly to the case for permanent hermetic seal

You can forget installation problems with General Electric Pyranol* capacitors . . . they're easy to install. Just lift the capacitor by the glass bushings—there's no danger to the unit.

EXCLUSIVE WELDED GLASS BUSHINGS, on 15 and 25-kvar units, 2400 to 7960 volts, have non-corrodible nickel alloy flange cast directly in the glass. The flange is welded directly to the case for strength and then soldered by induction heating for permanent airtight seal. Glass bushings provide liberal creepage distance and flashover strength with freedom from flashover troubles even under severe atmospheric conditions.

CLAMP-TYPE TERMINALS permit easy, solderless connections—speeding installation. One-piece neoprene insulating caps can easily be slipped over the terminals after connections are made to prevent shorting by birds or animals.

*Registered trademark of General Electric Company.

Remember, whether you need to increase kw capacity of feeders, transformers, regulators, or the entire system back to the generators . . . whether you want to improve feeder voltage levels . . . reduce overall losses . . . or defer the expense of major changes in feeder layout, General Electric Pyranol capacitors are the practical low-cost solution.

Capacitors are the only items of major electrical equipment that cost less today than in 1940. No other electrical investment does so much for so little.

Why not investigate the values of G-E Pyranol capacitors today? Contact your G-E Apparatus Sales Representative, or write General Electric Company, Section 441-6, Schenectady 5, New York.

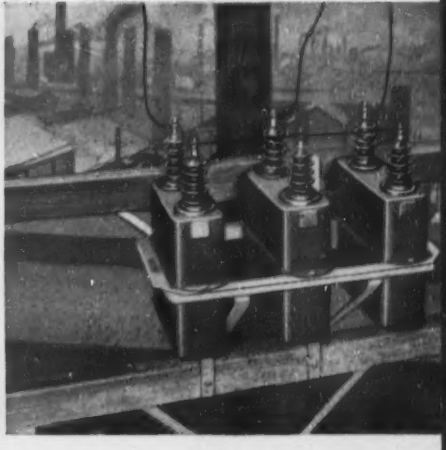
Progress is our most important product

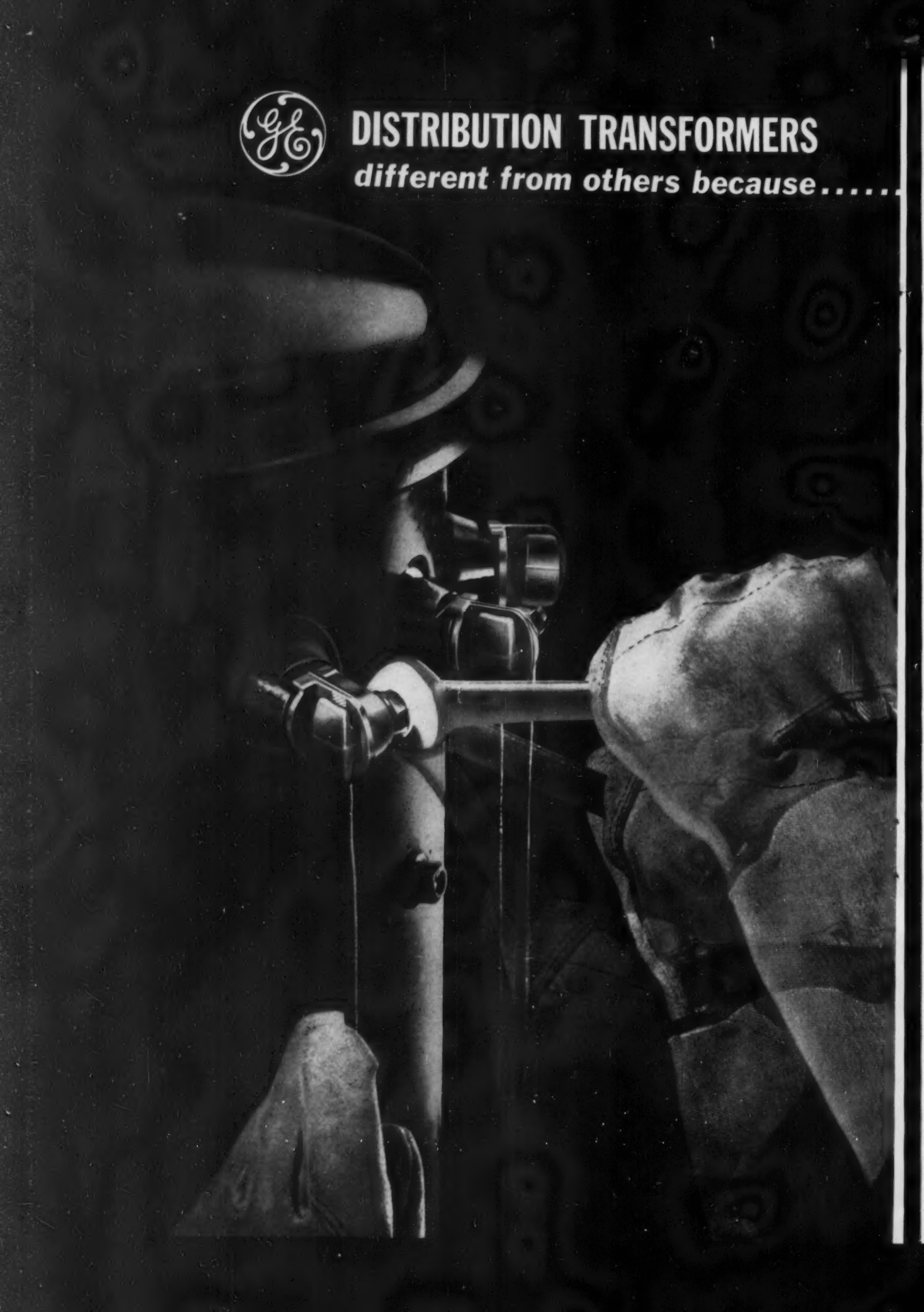
GENERAL ELECTRIC

SMALLEST AND LIGHTEST — Easier to handle and install —unexcelled reliability

WELDED GLASS BUSHINGS — Provide high mechanical strength—permanent hermetic seal

TRIPLE-PROTECTED CASE — Protects even in corrosive atmosphere —cuts repainting expense




DISTRIBUTION TRANSFORMERS
different from others because.....

....Strenicor pressure terminal clamps.....

minimize breakage due to stress-corrosion

Months or even years after installation, the strain imposed by tight connections may cause breakage of secondary terminals due to stress-corrosion (season cracking). This causes outages, service calls and customer inconvenience.

METALLURGICAL STUDIES of the causes of stress-corrosion led to the development of Strenicor—a new copper-nickel-silicon alloy. After successive solution and aging heat treatments, this alloy provides a high tensile strength of 107,000 psi—a yield strength of 83,000 psi. Thus General Electric Spirakore* transformers with Strenicor secondary terminals are practically immune to failure by stress-corrosion.

*Registered Trade-mark of General Electric Co.

REMEMBER . . . all transformers are not alike . . . compare the General Electric plus features in the chart below and see for yourself.

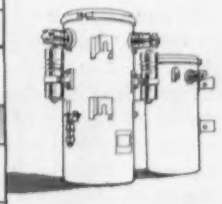
For more information on distribution transformers, either unit-type or conventional, contact your nearest G-E sales office, agent or distributor, or write to General Electric Company, Section 431-7, Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

ALL TRANSFORMERS ARE NOT ALIKE
(make this simple comparison and see)

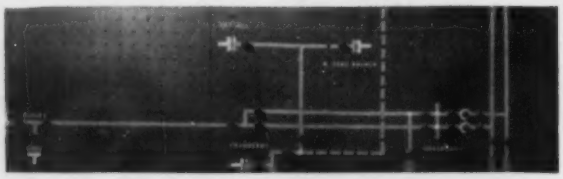
FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Insulated clamp-type connectors on tank wall hv bushings	YES	YES	YES	NO	YES	YES
One-piece cover band	YES	NO	NO	NO	NO	YES
Terminals designed for both copper and aluminum conductors	YES	NO	NO	NO	NO	NO
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	YES



UNIT-TYPE CONVENTIONAL

"Take your choice G. E. makes both"

Perforated Dispatching Board Design



A. H. Gravely, Jr, System Operating Engineer, Appalachian Electric Power Co, Roanoke, Virginia

Design and construction aspects are outlined for dispatching boards of the manual or dummy type using perforated panels and having flexibility for changing systems.

Two factors influence selection of perforated panels:

1. Various symbols and indications can be placed in the perforations and removed without marring the face.

2. All indications and diagramming can be applied uniformly with predetermined spacing as in layouts on graph paper. Revisions and maintenance can be facilitated.

For clearest perception of indications, no light should be allowed to come through the perforations from rear of the board, whether black or colored.

For the board face, steel is preferred because:

1. Possible use of magnetic symbols or indications.
2. Better affinity for most types of paints.
3. Slightly better durability in tapping perforation for symbols.

Specifications . . . Panels are punched-to-order sheets 16 gage cold-rolled steel with 5/32-in. dia holes on ⅞-in. centers, straight both ways, with a 7/16-blank margin on all four sides. Thinner sheets are not favored because of three requirements:

1. Ample thickness for tapping holes for indications.
2. Avoidance of buckling and resonance.
3. Substantial diagonal bracing for the supporting frame especially with large boards.

Selected spacing and size of perforations permit using "midget" jacks for switch or potential indications, and prevent too congested spacing of diagrams and symbols. Panel perforations facilitate 10/32 threading for the ½-in. long midget jacks. Center-to-center spacing is about the minimum allowable for clarity of diagram and symbols at average viewing distances.

Frames and Assembly . . . Sizes of sheets and construction of the frame depend on the specific location. Flat boards are most practical but curved or angular boards will incur little or no additional effort or expense.

Outside frame is generally standard ¼-in. angles, and ¼ x 2 x 2 in. vertical tee or angle members are used at points where the sheets are butted together on the face. Joints on the face of the board should be kept to a minimum, but sheets wider than 36 in. tend to buckle and resonate. Faces of vertical members are set flush with the faces of outside members to allow leeway in applying the sheets and permit wider choice of trim.

Application methods of perforated sheets are:

1. Lay out all sheets and check for best possible butting of edges and horizontal alignment of holes, as sheets may not be punched accurately. Then mark all sheets so they may be reassembled in the same arrangement.

2. Starting with center panel, position and clamp it in place. Then, starting at about center of sheet, drill at suitable intervals through existing holes with a 5/32 in. drill and tap for 10/32 thread. Draw up sheet snugly to frame with 10/32 machine screws, inserted either from the face or from the rear of the board, as they are to be cut off and ground flush. Continue toward each end until all sheets are in place.

Cleaning and Finishing . . . After assembling the sheets, thoroughly clean face of board of any shop grease, rust and scale by first scrubbing with mineral spirits and then rubbing down with a block sander or steel wool. Then apply the primary and finishing coats. For the latter, several thin coats, preferably sprayed, are superior to one or two heavy coats. Several types and colors of paint and the faster drying lacquers have been used.

A dull finish on the board face is important to eliminate glare. Black and the darker shades of gray-green are satisfactory. A harmonizing color may be used.

Satin-finish extruded-aluminum trim can be applied in a width proportionate to the size and shape of the board. Some shapes have 90-deg cover plates to conceal the corner joints, which need not be mitered.

Diagram and Symbols . . . Flexible layout and application of circuit diagram and indicating symbols (see illustration), so they may be rearranged or revised by station personnel, are obtained as follows:

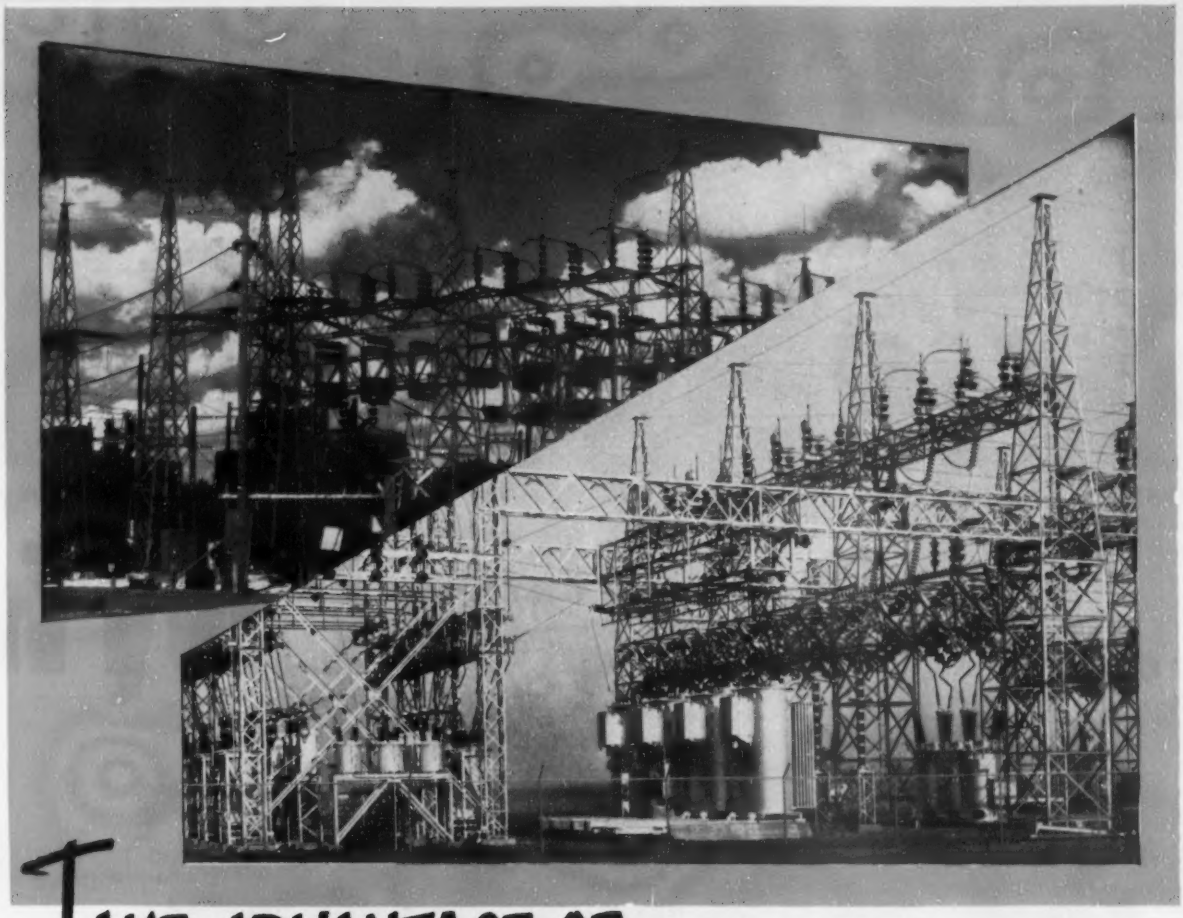
1. For diagramming the lines and bus work ¼-in. pressure-sensitive plastic tapes are currently used. Colored cellophane, paper, plastic and metal strips and also painted symbols have been tried. A silk-screen process of painting or stenciling was used with fair results.

2. For circuit and station labels both adhesive cut-out alphabets and laminated phenolic name plates are used.

3. For switch and other designations requiring a changeable indication, threaded miniature jacks are fitted with metal-and-plastic indicating plugs with red or green plastic heads.

4. For oil circuit breaker indications, ¾-in. colored plastic disks with a central hole are held in place by screwed-in jacks. A yellow disk denotes "ultra high speed" operation. Motor-operated and spring-loaded switches are designated by triangular and other adhesive symbols applied under the jacks. Air-break and disconnect switches are designated by jacks alone. Other symbols, such as transformers, are formed by colored tape or adhesive cut-out symbols.

Costs: Costs vary due to the necessity of developing sources of supply, the evolution of various parts, and changing labor costs. Costs for the frame, painting and labor can be estimated by the prospective builder.



TAKE ADVANTAGE OF

DELTA-STAR'S SUBSTATION EXPERIENCE

to reduce engineering costs — save your time

Delta-Star has been designing and building substations for the nation's expanding utilities for more than 30 years—and many of these stations have been repeat orders from companies who are more than satisfied with Delta-Star's resources and service.

DELTA-STAR has the knowledge based on proved design and engineering skill, and has worked out a practical standardized system of handling which reduces the time required for planning, fabrication and shipment to a minimum.

DELTA-STAR has the facilities. Component parts for equipment are in stock ready for assembly. Structural steel is accurately cut and punched, then hot-dip galvanized under precise control in our own shops. Careful checking and marking before shipment insures a "custom" fit.

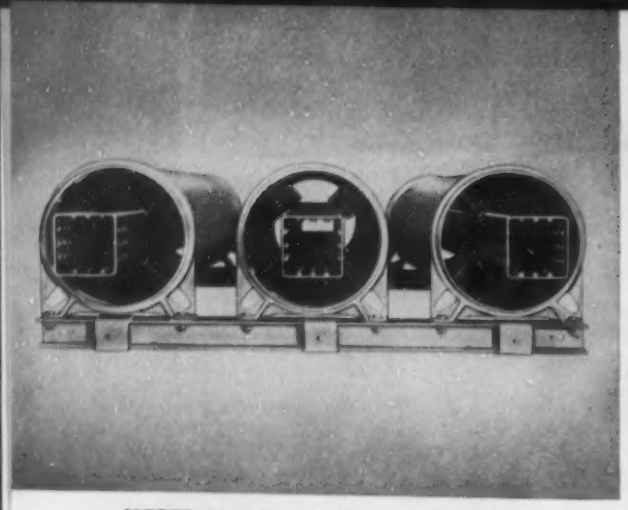
Every detail from anchor bolts to switching equipment is covered by drawings in the construction folder for quick and easy erection.

We shall be happy to consult with you on your substation requirements for any voltage rating and submit data on design, cost and delivery. Contact factory or nearest district office.

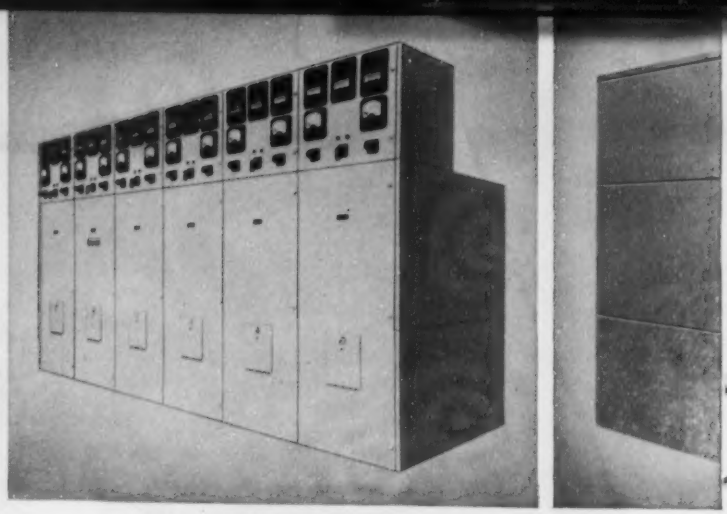
WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHING EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

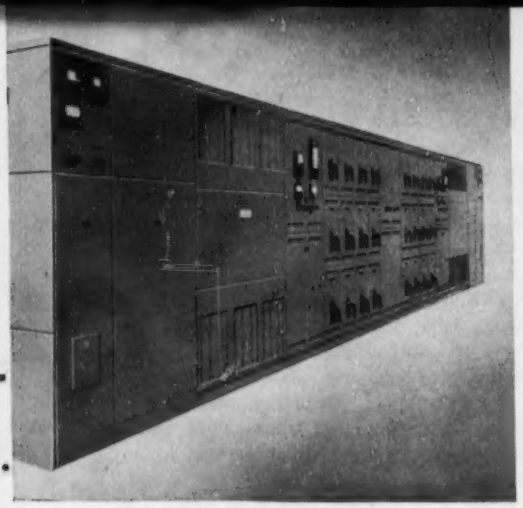


METAL-ENCLOSED BUS STRUCTURES

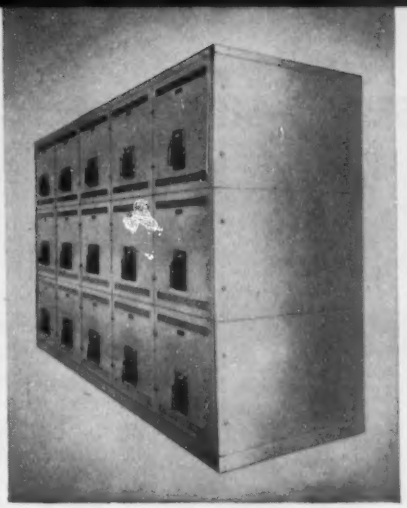


METAL-CLAD SWITCHGEAR

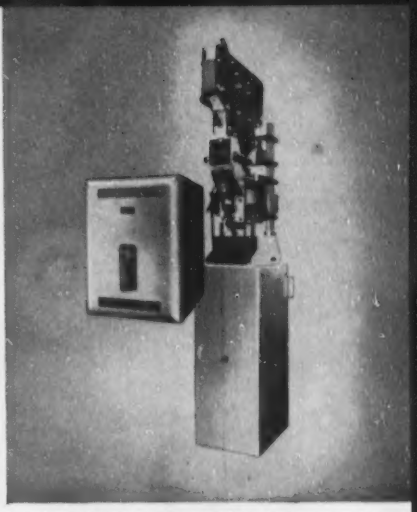
Put I-T-E



UNIT SUBSTATIONS



LOW-VOLTAGE SWITCHGEAR



LARGE AIR CIRCUIT BREAKERS

in your power plans...

for Dependability, Safety, and Over-all Economy

A complete line of Quality Switchgear Equipment

From generation to utilization, I-T-E quality equipment serves every industrial and commercial application. Whether your plans include bus structures, metal-clad or low-voltage switchgear, unit substations, or individual circuit breakers—you are assured of I-T-E's many *extra-service* benefits, which include:

1. selection and application of equipment
2. preparation of specifications
3. coordination of all job requirements

Power is fundamental in any new plant construction or expansion. Power distribution systems must be planned to assure maximum dependability of service, safety for personnel and equipment, and *over-all* economy—from initial planning . . . through the life of the equipment.

Furthermore, it is important to plan power systems with an eye to the future. They should be adaptable to changing plant requirements for many years ahead.

For these reasons, it pays to include I-T-E quality products in your power plans. For over 65 years I-T-E has set the standard for the industry—through engineering skill, design refinement, and introduction of new ideas and thinking.

For details, contact the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

THE SYMBOL OF QUALITY SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

SWITCHGEAR PRODUCTS

Reddy Kilowatt Slows Traffic, Protects Workers

SLOWING TRAFFIC is another job that "Reddy" performs effectively

Western Massachusetts Electric Co, Springfield, found the general run of "Men Working" road signs insufficiently effective in safeguarding outside crews against traffic hazards. To meet this situation Eugene H. Wessels, Jr, safety engineer, and others in the company decided to use a cut-out of Reddy Kilowatt. The new sign has several features not known to have been employed in one or two similar applications in utility circles.

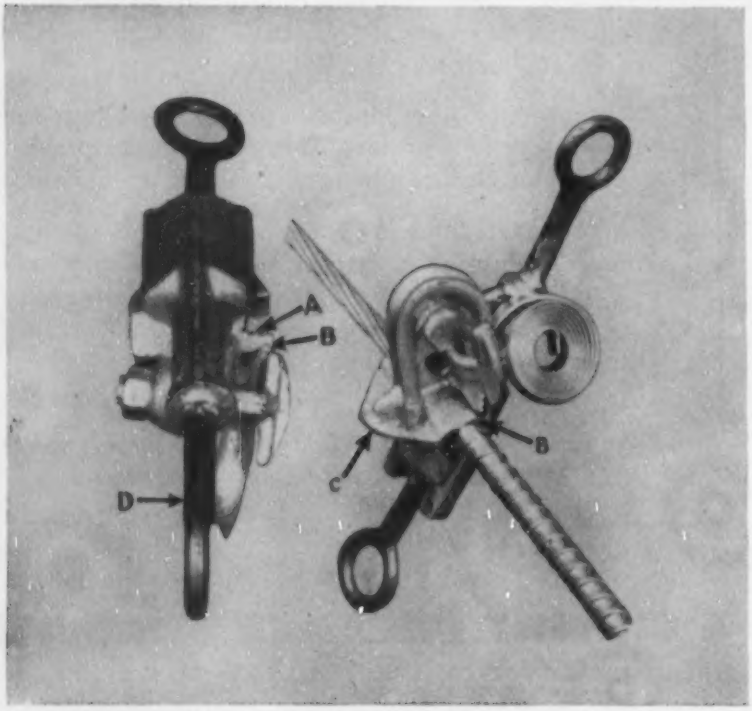
Requirements included greater visibility, attraction of more attention from motorists, portability, small size to permit easy storage in line or other trucks, light weight, foldability, and a structure sufficiently substantial to stay upright in all weathers.

"Reddy" is 4 ft tall, built of ¼-in. steel plate with a non-tipping base, and weighs 32 lbs. The sign "Reddy" holds is easily attached or removed by hooking it into eyes. Initially the unit was made by hand cutting with an acetylene torch; but this called for about 2.5 hours' work plus several hours more to file off the burrs. By using an automatic acetylene cutting machine loaned to the company, cutting time was reduced to 20 minutes. Much of the filing was eliminated by clean cuts made by the machine.

Present cost of each sign approximates $15, and enough have been made to equip the company's truck fleet. A helpful public relations angle appears in the reference to "Please Slow" in the work area instead of the widespread blunt notice that men are working at the site.

Modified Clamp Wraps Armor on Energized Lines

A. E. GALLAGHER, Distribution Dept, Ohio Power Co, Bucyrus, Ohio



METAL TAPE WRAPPER is a modified hot-line clamp and is easy to use on all lines

A modified hot-line clamp is being used to wrap armor tape on energized lines where hot-line clamps are to be attached. It will wrap aluminum, copper, or all-purpose tape uniformly with even spacing and little effort. This simple small tape wrapper is suitable for cold work as well as "hot" work, is easy to load and use, and does not lose its identity among the customary line-material equipment that is carried on the company's trucks.

The device illustrated was constructed with 2 manhours, from a hot-line clamp and a ⅜-in. galvanized guy thimble which holds the roll of tape. Details shown include: "A" is a ⅛-in. notch sawed in hot-line clamp to serve as guide for feeding tape at proper angle. A thimble is placed in the clamp wire-holder with one end resting on clamp lip "C", and the other end "B" just reaching edge of notch "A". Wire holder is tightened to hold thimble in place. For a more

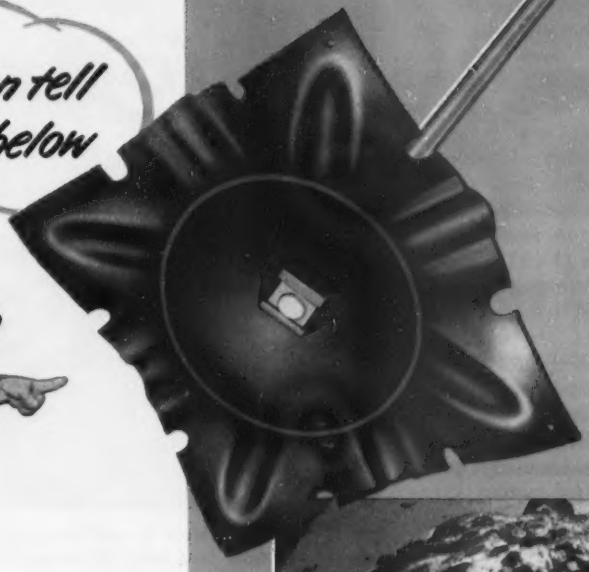
Give the Guy a CHANCE

Build lines to stay

with the CHANCE 8 Way

MIKE THE MOLE SAYS:

Only a mole can tell what goes on below "see" level!



Here's a typical example of a test result . . . This 200 square inch Chance 8-Way was pulled to nearly double its rated load without damage to the anchor.

CA54-4

MIKE'S RIGHT! You can't tell what happens to an anchor after it's installed unless it fails—or is pulled out in a test or dug out for examination. Chance has pull-tested all kinds of anchors all over the country to see what happens when anchors are subjected to heavy loads. These tests prove that the Chance 8-Way holds far more than its rated load because the eight blades expand to form a complete pyramid shaped square—there is no wasted space between blades. The guy load is equally distributed all around the hole.

8-Ways are available in a range of sizes for every requirement from guying rural phone lines to guying heavy transmission lines. There is a CHANCE Anchor Distributor in your area who can probably fill your order directly from stock. SPECIFY CHANCE FOR SERVICE!

ABC INDUSTRIES

A·B·CHANCE CO.

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

rigid tool, end of thimble can be welded to clamp lip "C". Thimble holds roll away from clamp mouth, and lower clamp lip rides on tape while wrapping it.

To use the tape wrapper, the end of the tape roll is threaded under the clamp wire-holder and through the groove in the thimble, so about 3 in. of tape extends below the lower lip for making the initial wrap. Corrosion-resistant paste is spread on both sides of the tape roll with a rope-end or brush to serve as a lubricant. This also reduces possbiility of arcing between tape and conductor.

Then the clamp is hung in the desired position on the line with a "shotgun stick", and tie-stick used to make initial turns of the tape around the conductor. With the initial turns gripped by a O-39 hot-stick the hotline clamp is tightened on the line until the lower lip of the clamp just rides the tape as shown. Then the tape wrapper is rotated around the line with a finger-type hot stick. This operation is aided by the extra eye (D) welded to the end of the clamp.

Commercial armor-tape wrappers are available but the one shown aids application of the corrosion-resistant paste.

Wood Structure Cuts Distribution Substation Cost

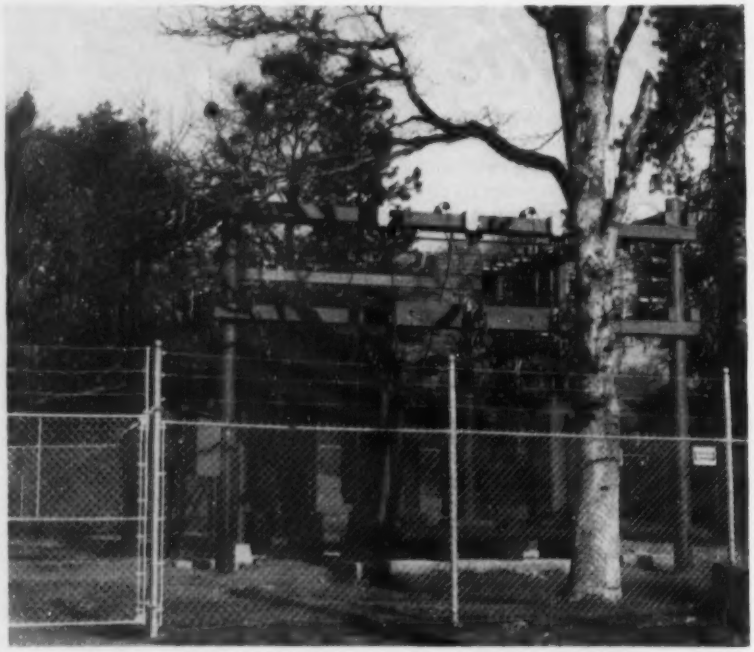
WARD HAMMOND, Distribution Engineer, California Oregon Power Co, Medford, Ore.

"Standard package" two-feeder substation designed and used by California Oregon Power Co is flexible, acceptable in appearance, and costs between $4,000 and $6,000 less than unit-type substation of same rating.

Primary feature of the 12-kv to 4-kv or 2.3-kv substation is use of wood poles for corner supports and 24-ft lengths of 6 x 8-in. timbers for horizontal members. Wood sections bolt together to form a structure measuring 23 x 23 x 17 ft overall. They are painted dark green to blend with foliage common to the company's service area.

Substation consists of three 500-kva, single-phase transformers, breakers, and feeder regulators, with disconnect switches provided for maintenance of breakers. Steel forms are used in pouring concrete slabs for various apparatus. Slabs are poured in sizes to accommodate three transformers on one size, three regulators on a second, and one breaker on a third.

Underground feeders for both voltages enter and leave the substation site through 6 or 8-in. drain tile and run to pipe risers on nearby poles. Single-conductor cables are supported at the top of the riser by a tight-fitting hardwood plug. Sealing compound is used to obtain a weatherproof termination.



PAINTED GREEN to blend in with background, two-feeder substation costs up to $6,000 less than unit type. Steel forms for pouring slabs help reduce cost

Dryer Keeps Hot Line Ropes Dry and Pliable

O. JENSEN, General Foreman
H. PETERSEN, Utility man
Colgate Division, Pacific Gas & Electric Co, Marysville, Calif.

Hot line ropes are dried reasonably fast and without loss of pliability at Pacific Gas & Electric Co's distribution center. Electric dryer was designed and built by the authors to keep ropes dry and pliable during rainy season. Cost of materials that were required to make the drier was about $30.

Dryer consists of wood frame with masonite sides and door and measures 6.5 ft high, 3.5 ft wide and 4 ft

(*Continued on page* 123)

ELECTRIC LAMPS in wood and masonite dryer maintain temperature at 80 deg

Experience

···guides the expert

In the matter of choosing proper insulation, the experts are the men working the line—designing, building, and maintaining it. Prior experience with lines on similar terrain, under similar conditions, is the most valuable single guide in their selection of insulation for current and future line building. That's why O-B insulators are chosen—time after time; property after property—after a first order has demonstrated its strength in service. Men who know the demands that will be put on insulators, because of past experience, get the type they want from O-B—with confidence!

Thirty-three years ago this line was built and energized. It has remained in continuous service, with increasing load as its service area has grown. The insulation has met every need. There have been no failures. We feel that this is one reason why the power company continues a thirty-three year old habit—it buys O-B!

Ohio Brass

MANSFIELD OHIO, U. S. A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

two things to select in an insulator

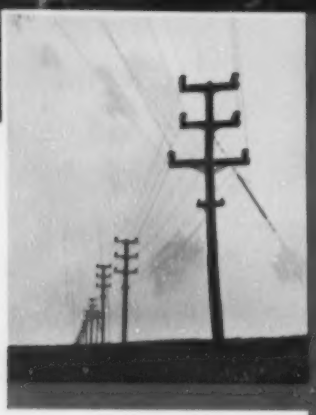
the *Right* type.... and the *Best* make

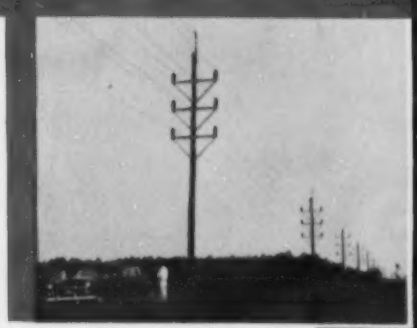
You can rely on O-B for both.

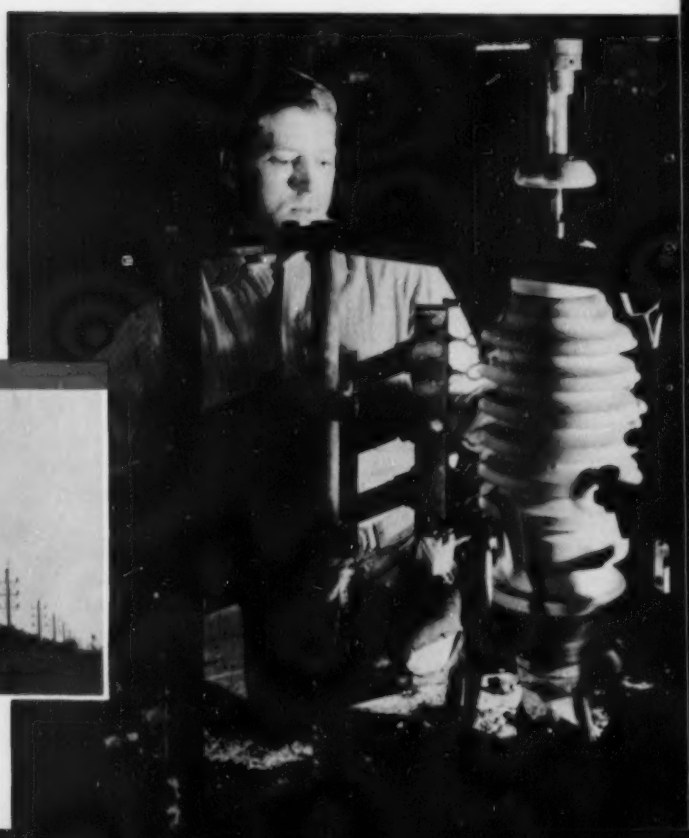
We make all types, and we make them in the best possible way. Each class—Pintype, Post, Suspension or Strain—gets the full and continuing attention of O-B research, design and manufacturing facilities. No weaklings, adopted for sales expediency, in the O-B insulator family. Whatever you get from O-B, you get the best—and the best we've got.

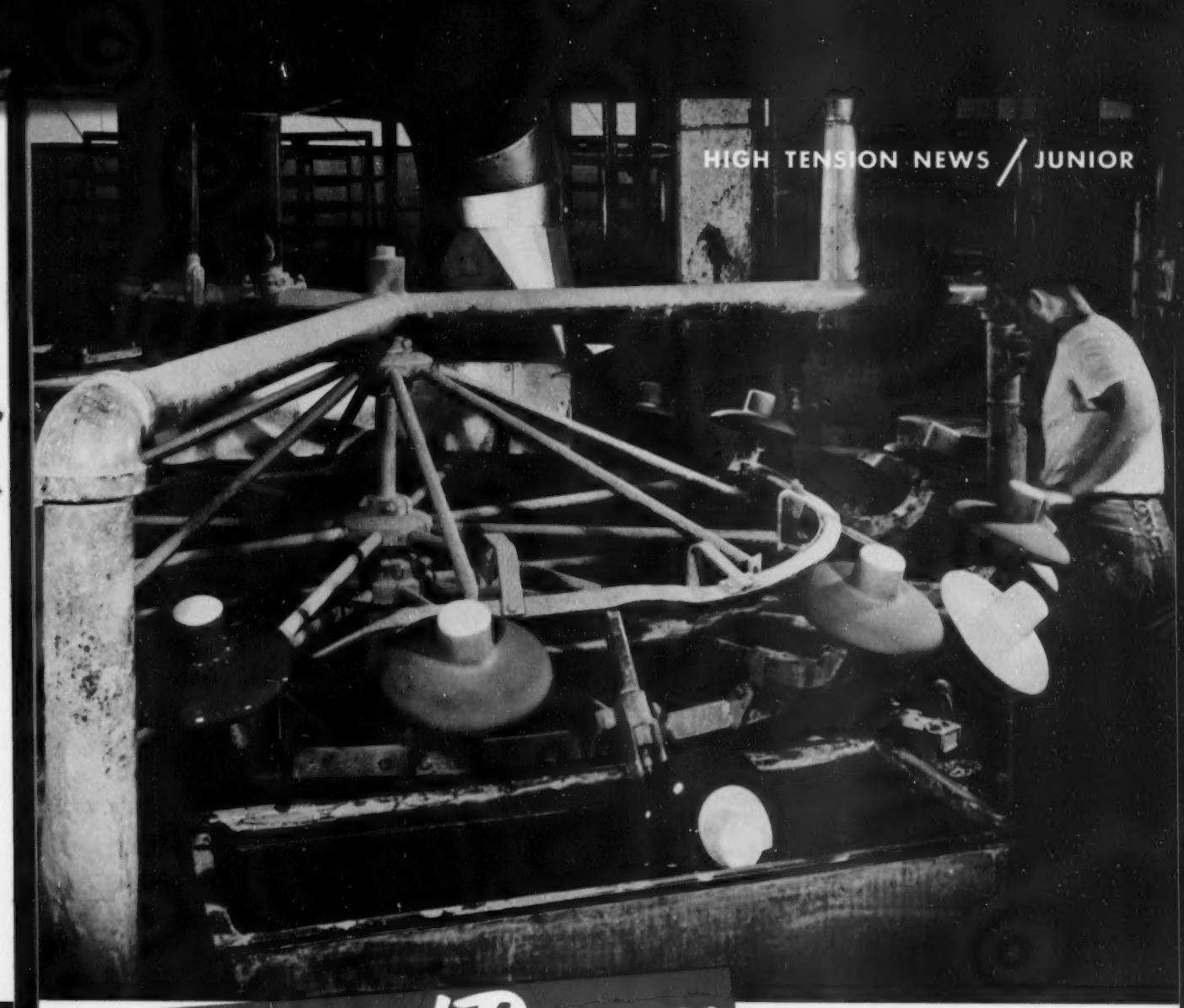
Choosing the right type depends on your knowledge of service conditions and previous experience in the performance of power lines. Getting the best make depends on your knowledge of the insulator manufacturer; on his ability to produce good insulation of all types.

And so, while the choice of *right* and *best* are both the line-builders' responsibility, there's a great amount of help to be had from Ohio Brass. You pick the type; it's our responsibility to *make* the best!









Improved Processes

improve the product

In making it our responsibility to make the best, Ohio Brass assumes an attitude of healthy skepticism toward established practice. Just because it's "been done that way for years" does not protect method from question; the fact is, old ways of doing things challenge, goad us toward making things faster, better, and of more value to the user.

An example: assembly line techniques applied to suspension insulator manufacture speed production, simplify quality control, and produce a more nearly uniform product. Such gains in processing as inconstant a raw material as clay advance the art of porcelain manufacture.

Such gains help us meet our responsibility to make the best!

INVEST IN SERVICE CONTINUITY WITH Ohio Brass INSULATORS

MANSFIELD OHIO, U. S. A.

You are within this circle!

Close cooperation between Ohio Brass Company and the Graybar organization keeps complete stocks of O-B Distribution Materials on hand at more than 100 Graybar warehouses all over the United States. Immediate action from the closest of these houses keeps you within the "overnight delivery" range (at the latest!)

Rely on O-B—Graybar to maintain a working stock of distribution materials for you. Talk it over with a Graybar man. He's worked out similar basic stock-on-hand requirements for other line builders, and he sees to it that they are maintained!

Ohio Brass
MANSFIELD OHIO, U. S. A.

No. 4427-H

Dryer

(*Continued from page* 118)

REMOVABLE TRAYS spaced about 11 in. apart speed drying of thoroughly wet ropes

deep. Five removable wood trays, spaced about 11 in. apart vertically, are mounted above three 200-w lamps. Vents in bottom of door and top of sides aid in movement of air through dryer.

When dryer was tested, ropes brought in dripping wet from rain were dried in about 4 hr. Temperature inside dryer reaches and is held at 80 deg.

Outrigger Bracket Eliminates Extra Pole

Outrigger brackets for providing sufficient clearance between static wire ground taps, which run down the pole, and energized conductors saved New England Power Co the expense of installing an additional pole per structure when a 66-kv line was converted to 115 kv.

Structures on which the brackets were used were made of a 50-ft and 30-ft pole with a 25-ft pole as the horizontal cross arm. A static wire for lightning protection was carried on the top of the 50-ft pole and ground taps were brought down contacting the pole.

To increase the voltage of the line it was necessary to increase the horizontal spacing of suspension insulators from 7 to 9.5 ft, add three insulator discs at each suspension, and provide proper spacing between the ground connection and nearest phase wire. The latter was accomplished by using two outrigger brackets per structure, which eliminated installing

"This Quality Control Number Is Your Proof that M·S·A FIRST AID KIT Items are Fresh, Pure, Sterile"

Every step in manufacture, all supplies that go into the new M.S.A. First Aid Kits are keyed to the number stamped on each Unit "D" package. This identity is your assurance of *individual responsibility* on our part . . . the best possible guarantee of product protection to you.

MORE THAN 60 ITEMS GIVE YOU COMPLETE SELECTION

You name it, we have it! 12 different packages of antiseptics; 15 various kinds and sizes of bandages and dressings; over 21 burn treatments; and more than 15 miscellaneous items, including eye treatment, snake bite kits, poison ivy ointments, and many others. Write for details.

SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES CO.
201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 82 Branch Offices in the United States and Canada

GET COMPLETE FACTS ON THE NEW M·S·A FIRST AID KITS . . .

Clip and send today

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COMPANY_____

ADDRESS_____
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Attach to Company letterhead, mail to:
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EW

Locate line faults instantly at ranges 1/2 to 200 miles

Model 124 Line Fault Analyzer

Now you can locate power, telephone or telegraph line faults instantly and accurately under all weather conditions. Sierra Model 124 Analyzer eliminates virtually all lost time, hard work and hazard of finding breaks, shorts, opens or other discontinuities. Operating from a powerhouse, transformer bank, substation or terminal point, it pinpoints faults from ½ to 200 miles away with accuracy of ±1 mile on the 200 mile range.

The Analyzer operates on radar techniques, sending a high amplitude pulse along a conductor and presenting echoes from discontinuities as pips on a radar-type "A" scope. Operation is extremely simple, and distances are read direct in miles. Calibrated sweep ranges of 5, 25, 50 and 100 miles are provided. A sweep delay extends range to 200 miles, or permits line segments as small as five miles to be presented full-screen. A movable distance marker can be ranged from 5 to 100 miles.

Model 124 weighs just 59 pounds; and is completely contained in a weatherproofed carrying case.

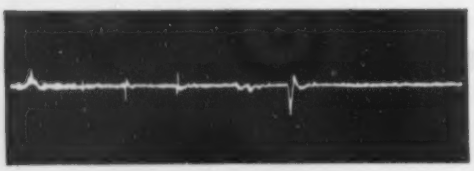


Figure 1

Test on 60 kv line, instrument on 100-mile sweep. Negative pip to right of center indicates line grounded at 60 miles. Other pips are switchyards, transformer bank, substation tap, carrier coupling capacitor, change in line configuration.

Copyright 1953 Sierra Electronic Corporation

8748

For complete details, see your Sierra sales representative or write direct for Bulletin 1028

sierra

Sierra Electronic Corporation

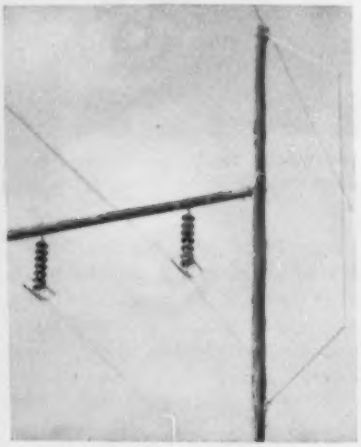
San Carlos, California, U. S. A.

Sales representatives in major cities

Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Directional Couplers, Wide-Band RF Transformers, Custom Radio Transmitters.

a 55 ft pole beside each structure to carry the static wire.

One bracket was bolted to the 50-ft pole's top and another was attached 10 ft diagonally below the nearest phase wire. An 8-ft length of 2-in. aluminum pipe was seated into each outrigger bracket. A ¼-in. triple stranded steel ground tap was then attached to the static wire, run through



OUTRIGGER SCHEME carries ground wire away from pole to provide clearance when a 66-kv line was converted to 115 kv

the upper aluminum pipe, down to and through the lower pipe, where it was connected to the ground wire running down the pole. Open air section of the ground wire between the two pipes was about 15 ft long.

Each outrigger bracket weighs 7.5 lb, has a 4 x 8-in. pole plate, and is secured by a ⅝-in. bolt. Two grooves in the clamping plate are available to acommodate the static wire connection.

Magnetic Shield Eliminates Voltmeter Pen Vibration

R. F. RANDELS, Meter Engineer, Standardizing Laboratory, Ohio Power Co, Canton, Ohio

A magnetic shield was developed to shunt synchronous motor flux away from the armature of a graphic voltmeter and thus prevent pen vibrations without preventing starting of the motor at 90 volts. Records made on an instrument before and after installation of the shield showed that performance had been improved considerably.

Magnetic shield is formed from two

CONVENTIONAL 7-CONDUCTOR #9 AWG IN 1¼" CONDUIT.

ALMOST DOUBLES YOUR CONDUIT CAPACITY

PNR 12-CONDUCTOR #9 AWG IN 1¼" CONDUIT.

ROCKBESTOS PNR

SMALL DIAMETER CONTROL CABLE

Here's a smaller, lighter control cable that saves you labor, conduit, fittings. Approximately ½ the size of conventional control cable, Rockbestos PNR lets you pull 12 conductors where before you had only 7.

Millions of feet are now in service. Get the full PNR story. Find out where it can save you time and money. Write today, or call in your nearest Rockbestos representative.

PROPERTIES OF PNR

46% smaller in area . . . 28% smaller in diameter than conventional control cable. Use smaller conduit and fittings or put more conductors in existing conduit.

Lighter, easier to handle, store, ship, pull through conduit.

Dielectric breakdown . . . over 40 times operating voltage.

Rated 600 volts . . . conductor operating temperature 168°F.

Flexible from 168° to —67°F. No cracking!

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONN.

NEW YORK • CLEVELAND • DETROIT
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UNSEEN in the picture...

but constantly and automatically on duty providing the utmost in photoelectric Street-Lighting Control. The Ripley "double-duty 60" SUNSWITCH Control is the latest unit in a proven line of photoelectric controls for Street-Lighting that have been operating successfully on lighting circuits for over 18 years.

Low first cost, simple installation and minimum maintenance make Ripley SUNSWITCH the ideal solution to your Street-Lighting Control problem.

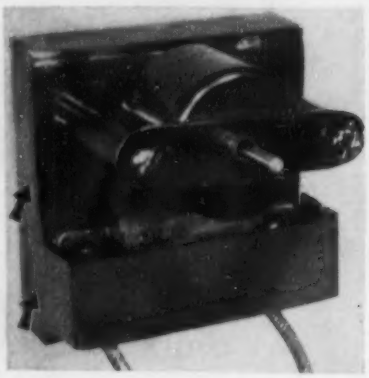
For the complete story write for Bulletin S-60.

RIPLEY
ESTABLISHED 1934

RIPLEY COMPANY, INC.
MIDDLETOWN, CONNECTICUT

pieces of 32-gauge tin-plated sheet iron soldered together, and attached to the motor with field mounting screws.

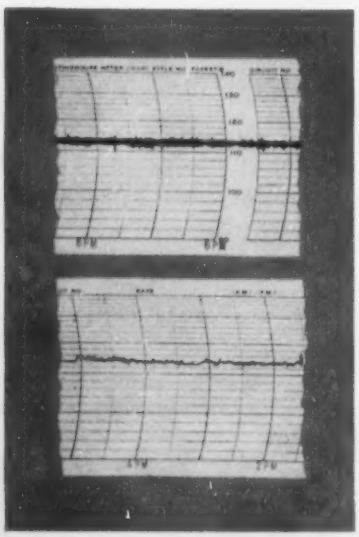
Such shields are currently being installed on both new and old graphic voltmeters when they come into the standardizing laboratory for either repair or test. Our old meters have also been equipped with the factory shield provided on newer instruments be-



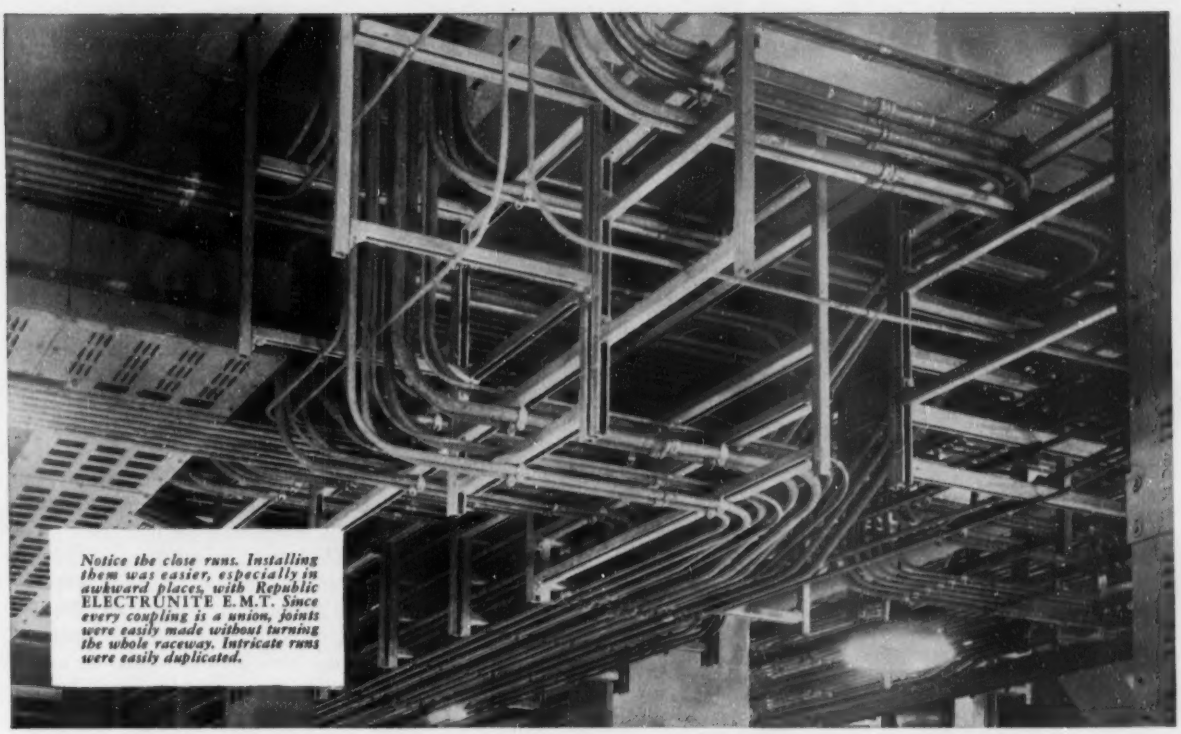
MAGNETIC SHIELD shunts field flux of Warren motor from graphic voltmeter

tween the solenoid and the motor field coils.

While pen vibrations could be eliminated by a damping liquid, that was not applied because many of the voltage fluctuations that were wanted would have been damped out by such a device.



VOLTAGE VARIATIONS were obscured in pen vibrations (top) before shielding was installed. After installing shielding (bottom) voltage fluctuations are evident



Notice the close runs. Installing them was easier, especially in awkward places, with Republic ELECTRUNITE E.M.T. *Since every coupling is a union, joints were easily made without turning the whole raceway. Intricate runs were easily duplicated.*

REPUBLIC ELECTRICAL METALLIC TUBING helps lower power plant building costs

When Kaiser Aluminum and Chemical Corp. built its new plant at Chalmette, La., a lot of Republic ELECTRUNITE E.M.T. was used.

One of the big reasons was its light weight. That meant light supporting members rather than heavy girders. It adds up to lower building costs. And since Republic E.M.T. is easy to install, installation costs were lower, too.

The zinc coating on Republic E.M.T. withstands 4-dip Preece Test, as covered by Underwriters' Laboratories' Inspection; also meets American Standard Specification C80.3 and Federal Specification WW-T-806. It is also approved by the National Electrical Code for exposed, concealed or concrete slab construction.

Before you specify your power plant raceways, get all the facts about savings with Republic E.M.T. You'll be ahead whether you're planning new installations or revamping. Write for Booklet SA-54.

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REPUBLIC ELECTRUNITE E.M.T.
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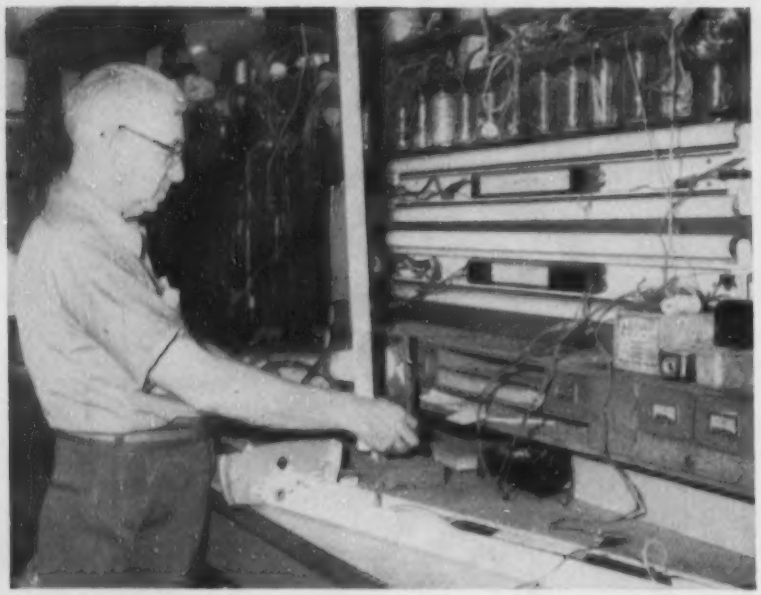
"INCH-MARKED" *The Mark of Quality*

Made by the producers of ELECTRUNITE . . . The Original Electric Welded Boiler Tube



L. R. JUDY, head of electrical department, shop tests fluorescent tubes, starters, and ballasts

Lighting Maintenance Pays . . .

Maintenance crew consists of one electrician and two helpers. Electrician inspects all equipment and replaces defective units

. . . in lower costs and better illumination for schools in Birmingham, Ala.

Planned maintenance by a special crew for school lighting is saving Birmingham, Ala. considerable expense and insures high intensity illumination in all classrooms.

The procedure for cleaning fixtures and replacing defective tubes, starters and ballasts was developed by Fred L. Kelly, manager of the business department, after considerable experimenting following the installation of fluorescent lighting in all the schools.

Kelly says that the procedure allows time for the electrician to make any needed electrical repairs at a school at the same time lighting maintenance is in progress. This insures routine electrical inspection and maintenance of equipment.

The Birmingham school system consists of 86 schools which have 215 school buildings and two administration buildings. There are 59,125 students. All schools have fluorescent lighting in standard classrooms 22 x 30 ft or 22 x 40 ft and a few 25 x 25 ft in the older buildings. Classrooms are lighted with twelve fluorescent fixtures spaced to provide an even distribution of light. Minimum intensity is maintained at 30 ft-c but in most cases the intensity is from 35 ft-c to 40 ft-c. The long range program is to install a middle row of fixtures in each classroom to bring the intensity up to 50 ft-c. There are more than 60,000 fluorescent tubes installed.

Before the present maintenance procedure was adopted it was customary for the electrical crew to supply each school with a stock of fluorescent tubes, a few starters and ballasts. The building custodian generally maintained the lighting.

This was not satisfactory because minimum lighting intensity was not well maintained, there was excessive use of tubes, starters and ballasts. Many times an electrician was called upon to make a special trip for repairs and adjustments.

Under the new procedure the maintenance crew consists of six men—two work on clocks, bells, thermostats and other equipment; L. R. Judy, head of the electrical department, supervises all work and the maintenance of the lighting systems; one maintenance man and two helpers clean fluorescent tubes and fixtures and replace tubes, starters and ballasts.

The crew works the schools in rotation, with special attention given the high schools during the summer vacation. Primary and elementary grade schools are worked while classes are in session without interruption of lessons. The crew has a portable steel-frame platform mounted on rubber casters with the width of the legs spaced to straddle the desks.

Two-Day Plan . . . The crew can inspect, clean and maintain all fixtures in a school in about two days. This consists of washing all tubes and fixtures and replacing tubes and ballasts and starters when necessary.

Maintenance and cleaning are more frequent at the schools located in districts of high industrial occupancy. This is especially true where there are iron and steel foundries.

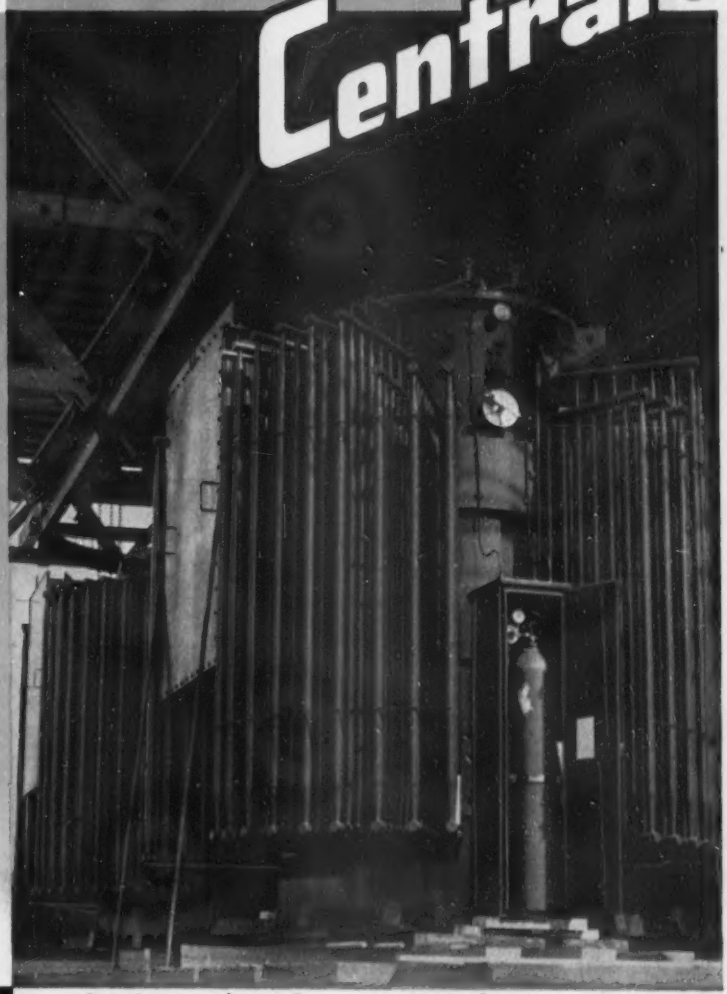
Experience has beeen that fluorescent tube rep.acement runs in cycles, varying from school to school and depending upon tube life and use.

(*Continued on page* 132)

★ Phone us regarding your own transformer needs

TRANSFORMERS?

We build 'em small, we build 'em big; but every single one is QUALITY-BUILT, at Central!



7 REASONS for Superiority of Central Transformers:

1. *Skilled, Conscientious Workmanship*
2. *Tried-and-Proven Dependability*
3. *Trouble-Free Performance*
4. *Minimum Maintenance*
5. *Long Life*
6. *Reputation—Thousands in use*
7. *Prompt, Efficient Service*

Designed to Eliminate Radio Interference

CTC Central TRANSFORMER CORP.

A Type for Every Need

Oil- or askarel-immersed transformers to 15000 KVA. Three phase, class "B" dry type transformers to 2500 KVA three phase. Shown above are 2 of 8 recently-built 5000 KVA units.

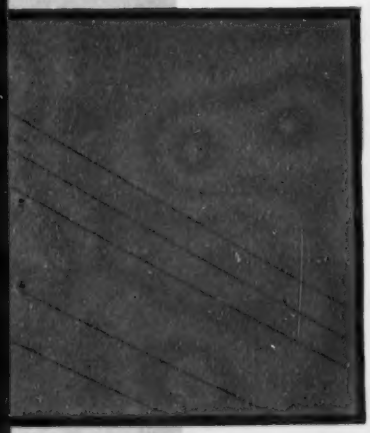
NEMA MEMBER

PINE BLUFF, ARKANSAS *Sales Offices in Principal Cities*

C-D
best by
FIELD

It takes a hotfoot with a grin, and comes right back for more. Yes, there are C-D capacitor installations that have been standing out in the blazing desert sun, day in and day out for over 10 years—*with little or no maintenance required.* This severe service requirement is one of the reasons why C-D builds them bigger—for better dissipation of heat. That is why too, C-D capacitors have the lowest volt-ampere per square inch of radiating surface.

TEST



Still another reason why C-D's have this unusual trouble-free performance record, even under desert conditions, is their superior design that calls for the highest major insulation level and the lowest dielectric unit stress. Insure low-maintenance service from your next power-factor installation, by talking it over first with a C-D engineer.
Cornell-Dubilier Electric Corporation,
Dept. 34, South Plainfield, New Jersey.

ONSISTENTLY EPENDABLE

CORNELL-DUBILIER CAPACITORS

FOR POWER-FACTOR IMPROVEMENT

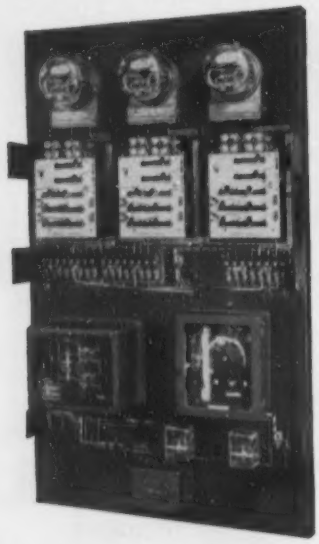
PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY: THE RADIART CORPORATION, CLEVELAND, O.

THERE ARE MORE C-D CAPACITORS IN USE TODAY THAN ANY OTHER MAKE

Transformer Loss Compensator

Saves you Money!

SPECIAL FEATURE: It saves you money because it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the transformer.



THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced with two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

Get your book now FREE

Detailed information on operation, installation, applications. Write for Bulletin NO. 62-A.

EASTERN SPECIALTY CO.

PHILADELPHIA 40, PA.

Lighting Maintenance

(*Continued from page* 128)

Thus, when tube replacement in any school becomes fairly frequent, the procedure is to make a complete renewal.

Trouble with ballasts has greatly diminished since development of more efficient equipment. Most of the old ballasts have been replaced. In the 1951-52 school year the system purchased 116 ballasts and used 84, as compared with 50 ballasts used in the 1952-53 year.

Experience with starters is that ones that are not defective may produce slow starts in one school but do very well in another which is located close to a transformer and the voltage is high.

All defective starters and ballasts are replaced by the maintenance crew and the defective ones returned to the shop for testing. Ballasts that hum may be used in shops and other places where the noise will not interfere with work.

Considerable savings have been effected by this procedure. The electrical shop is now experimenting with repairing starters to determine economic possibilities.

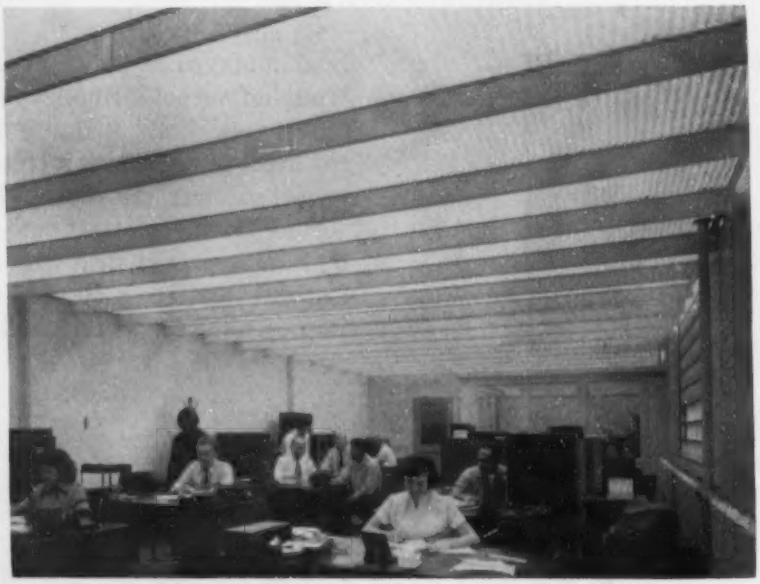
During the 1951-52 school year the system used 864 new starters as compared with 710 in the 1952-53 year.

The school system has standardized on 4500 deg white tubes and is now replacing all daylight tubes.

In the 1951-52 school year the system purchased 6912 new tubes, had 460 in inventory and used a total of 7320. In the 1952-53 year the system had a carryover of 370 tubes, purchased 5282 and used a total of 5602.

Kelly feels that the present system of placing the responsibility of light maintenance in one special crew is far better and more economical than for each school to do its own maintenance.

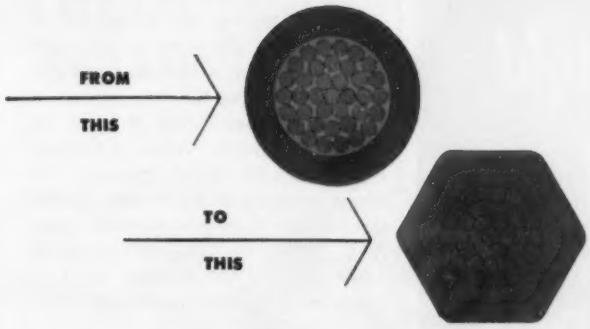
Actual cost data for just light maintenance is not available, since the light crew is called upon to make other electrical repairs. However, department operating figures do show that the maintenance program is producing better classroom lighting and expenditures for fixtures, tubes, starters and ballasts are less now than when the lighting system was installed.



Utility Installs Luminous Ceiling

Absolutely shadowless illumination averaging 70 ft-c is obtained in the storeroom office of the West Penn Power Co at Connellsville, Pa. The luminous ceiling of Vinyl plastic is 9 ft from the floor. In the 3-ft space above are hung 84 instant-start 40-watt fluorescent lamps in rows 3 ft apart. The room is 52 ft long, 19.5 ft wide. Power requirement is 4 watts per square foot.

T & B METHOD



. . . IN SECONDS

Compression Terminal

THE EASY WAY TO CONNECT COPPER OR ALUMINUM CABLE

Linemen, electricians and contractors pick the T & B METHOD of making electrical joints for the ease and speed with which tight, electrically-sure connections can be made . . . right on the job. Simply pare off insulation . . . insert cable into fitting barrel . . . and operate hydraulic tool (hand, foot or electrical).

The hardened steel dies of a light-weight, portable T & B hydraulic tool compress around the joint with tremendous hexagonal pressures and force the fitting and cable, into one homogeneous mass . . . all in a few seconds. The all-around pressures exerted over a large area assure maximum contact . . . minimize electrical resistance and voltage drop.

Though the use of an oxide-inhibiting agent is recommended for T & B METHOD *aluminum* connections, no joint compounds are needed to obtain maximum electrical efficiency. For *copper* connections, no special cable treatment is required.

T & B METHOD fittings for aluminum have fine serrations inside the barrel which, during compression, penetrate the insulating film of aluminum oxide on the outside cable strands. At the same time, the oxide film on the inner cable strands is effectively abraded, thereby maintaining a dense, tight joint of high conductivity.

Investigate the complete line of T & B fittings for aluminum and copper cable — they offer you savings in time and installation costs. Write for your free copy of T & B Bulletin #67.

LOOK FOR THIS SIGN— AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T34

THE THOMAS & BETTS CO.

INCORPORATED

14 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

When you think:

Fully Automatic Light Control

You should say:

LUMATROL®
PHOTOELECTRIC
LIGHT SWITCH

NEW! OMNI-DIRECTIONAL SENSITIVITY—INTEGRATES LIGHT FROM ALL DIRECTIONS!

Here's Why:

In simplicity, efficiency, and continuing low cost, the LUMATROL Photoelectric Light Switch is unmatched by any other light control device!

A Few Facts:

The LUMATROL Photoelectric Light Switch rates first on all twelve specifications normally applied to this type control. These include size, weight, volume, sensitivity, time delay, power consumption, safety, number and type of parts, and method of installation.

Most Important:

LUMATROL is sensitive to the average of existing light, integrating it from all directions. This exclusive feature greatly increases both efficiency and economy of the lighting system. Installation is quick and simple . . . just plug it in . . . and there are no relays, no mercury switches or troublesome condensers to maintain.

WRITE FOR TECHNICAL BULLETIN

micro balancing
INCORPORATED
GARDEN CITY PARK, L. I., NEW YORK
® Trade Mark Reg. U.S. Pat. Off.

Lamp Sales Triple Campaign Quota

All expectations and previous company records for similar activities were broken by a lighting campaign conducted during the last quarter of 1953 by Central Power & Light Co of Corpus Christi, Texas. Company employees sold 23,881 "pin-up" wall lamps, retailing at $4.78 each, in the three-month sales period. Sales more than tripled the original quota of 7,774 units. An average of 15.1 lamps was sold for every 100 CPL customers.

A one-month campaign for the sale of lamp bulbs was also well over the quota of 155,432. Employees sold 236,851—an average of one and one-half bulbs for every CPL customer. All employees were encouraged to participate in the sales campaign. Lamps and bulbs were stocked in all the company's 71 local offices throughout South Texas, most of which normally sell no merchandise.

Extensive advertising in over 100 newspapers and 22 radio stations in the area pushed the drive. Dealer helps, displays and campaign sales booklets were provided all local offices, and liberal commissions and bonuses were offered to employees. Considerable competition between company and district offices also highlighted the drive. Employee meetings and shows in each of Central Power & Light's seven districts kicked off the activity, and frequent progress reports—showing sales by leading employees and districts—were issued throughout the campaign.

Principal objective of the campaign was to promote better residential lighting as one effective means of building winter load. CPL's highest customer demand occurs in summer, and has been going up sharply with increased use of air-conditioning.

Range Teaching Kit

One of the newest projects of NEMA's Electric Range Section, is a teaching kit.

Single copies of the kits are offered free to home economics teachers and instructors on request addressed to the Electric Range Section, National Electrical Manufacturers Association, 155 East 44th St, New York 17, N. Y. They are available in quantities to utilities, distributors, and others.

Less dust for St. Louis housewives...

Boiler No. 5 Stack and Precipitator left—before precipitator start-up right—precipitator in operation [boiler load 200,000#/hr.]

Anheuser-Busch leads the way with AEROTEC Electrical Precipitators

The brewers of famous Budweiser Beer know the importance and value of good public relations. Not content with just meeting local requirements for dust control, the Company sets the pace for air-pollution control in St. Louis.

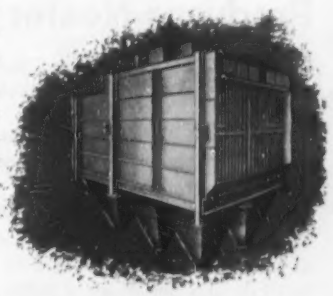
Together with an existing mechanical collector, the first of five Aerotec Electrical Precipitators at Anheuser-Busch *is collecting 2000 lbs. of dust every 60 minutes from a single stack.*

The remaining four electrical precipitators are about to be placed in service, and dust emission will be less than one fourth of the maximum allowable under the requirements of St. Louis' dust ordinance.

Reasons for Aerotec's higher collecting efficiency are:

- Pocket-type collecting electrodes prevent precipitated dust from re-entering gas stream.
- Exclusive flat high voltage plate presents a field of uniform maximum intensity for most effective precipitation.

For other advantages of Aerotec Electrical Precipitators write or call our project engineers—Thermix Corporation.



Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

Electric Molds Cut Recapping

JOE W. PARRIS, Georgia Power Co, Atlanta, Ga.

The use of electrically heated tire capping molds at the Gordy Tire Co, Atlanta, Ga has reduced operating costs, provided better and safer working conditions and improved the quality of the recaps. The passenger car tire electric molds have proved so successful that the company has recently installed electric molds for truck, tractor, and aircraft tires.

Formerly, steam-heated molds were used. These required from 327 to 585 lb of steam at a cost of 50 to 90¢ per recapped tire.

The Electric molds (for passenger car tires) are rated at 2,400 w and average power cost per recap is about 2¢. About 1 hr and 10 min is required to "cook" each recap. Company operates on 24-hr basis except on Sundays. Electric hoists permit one man to operate a mold.

The well-insulated electric molds confine the heat to the cooking space and very little is lost to the air. Working conditions are comfortable, even in summertime—not so with the formerly used steam molds. Furthermore workers cannot get burned with the electric molds.

Tire recapping department has 29 2,400-w passenger tire electric molds, 12 4,160-w truck tire molds, three section molds of 5,000-w and two of 6,250-w capacity. There are 14 connection points so that tire matrix can be preheated and then transferred to the truck molds to save time. This is an emergency arrangement until new molds on order arrive for installation.

Power is served by three 100-kva transformers. Present load is about 250 kw. Demand averages about 50% and monthly power use is about 120,000 kwhr.

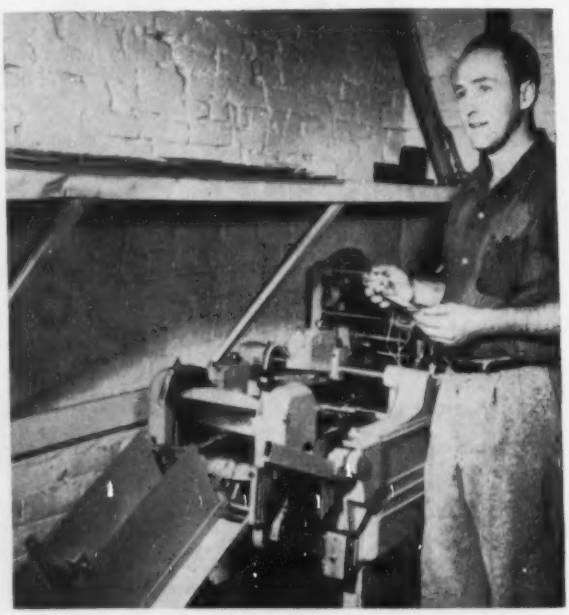
BETTER AND SAFER WORKING CONDITIONS lower operating costs and better recaps are produced by electrically heated recapping molds. Well-insulated molds eliminate danger of workers burning their hands as they frequently did when steam molds were used

Electric Heat Produces Neater Packages

R. M. PIZZA, Consultant, Business Development Dept, Utah Power & Light Co, Salt Lake City

Imagination and electric heat have been combined to produce cellophane tubes for neatly and attractively packaging peppermint candy canes for the Hall Candy Co, Salt Lake City, Utah. By modifying a standard bag maker, the company is able to produce cellophane tubes closed at one end in widths from 1 to 10 in. and in lengths up to 19 in. at a rate of up to 6,000 per hour. The machine is rated 1 kw at 110 v and costs about 3.65 cents per hour to operate.

Primary aim was to produce an attractive package for one of their specialty products, candy canes of 7, 11 and



BETTER PACKAGES for candy canes are turned out by this bag maker that uses a special template to adjust width and length of tubes and about 1 kw of heat to seal one end

Protect

YOUR LINEMAN
AS WELL AS
YOUR LINE WITH

BLACKBURN Aluminum FITTINGS

Time-Tested in Field Operation

NO HAZARDOUS TOOLS REQUIRED

When that storm emergency call comes through, linemen appreciate the easy, safe way they can install BLACKBURN Aluminum Fittings with their standard hand tools.

Engineers and operating men can specify BLACKBURN Aluminum Fittings with confidence because they:

- Protect conductors, by distributing unit pressures over large area.
- Provide wide separation of dissimilar metals—insuring against galvanic corrosion.
- Are made with corrosion resistant alloys.
- Are time tested in field operation under all weather conditions.
- Available in varied designs as illustrated.

Send for free literature and samples

Available through electrical wholesalers everywhere

JASPER BLACKBURN CORPORATION

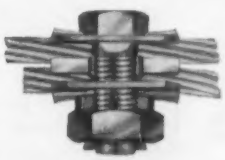
35 Madison St. • St. Louis 6, Mo. • *Phone:* CEntral 3007

TYPE PAA-400
For Aluminum Conductors through 400 MCM

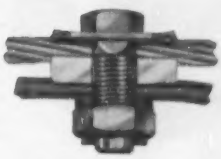
TYPE PAC—For Aluminum Conductors through 336.4 MCM; Copper through 2 str.

TYPE DLC—For Aluminum Conductors through 1/0 ACSR

TYPE PAA—For Aluminum Conductors through 336.4 MCM



TYPE AAW—For Aluminum Conductors through 4/0 ACSR



TYPE CA—For Aluminum Conductors through 4/0 ACSR; Copper through 4/0

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

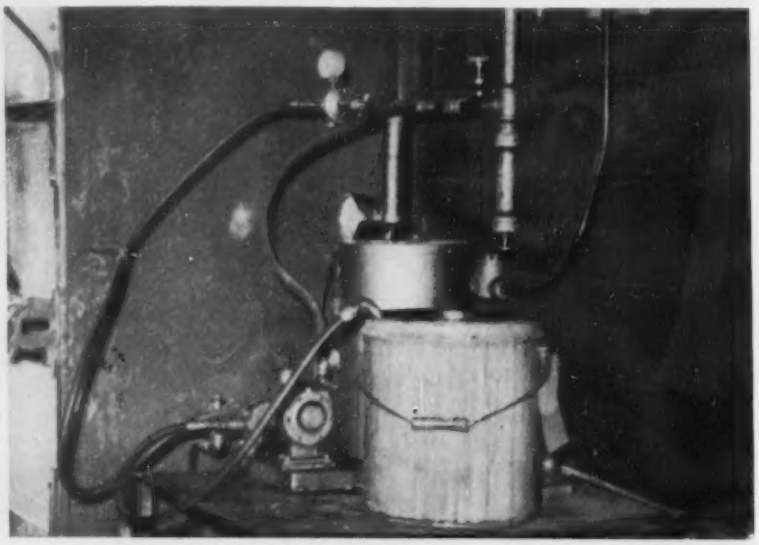
● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

14-in. lengths and about ½ in. in diameter, with a reasonable saving in labor costs. Previously the company bought cellophane bags available as stock items or on special order in 11 and 14-in. lengths and open at both ends. Packing the three sizes of canes in these two lengths produced an unattractive package. Furthermore, extra time and labor were required to seal one end before the canes were inserted.

The company acquired a bag maker and designed a template that permits the making of cellophane tubes over a wide range of widths and lengths. Electric heaters in the machine seal one end of the tubes as they are formed and before the canes are inserted.



IMMERSION HEATERS in tank adjacent to spray booth heat varnish and paint before spraying. Better paint job is produced and paint and varnish are saved

Hot Spray Method Cuts Painting Costs

D. E. DOME, Commercial-Industrial Dept, The Ohio Power Co, Newark, Ohio

Spray painting and varnishing of saw handles at Larsan Mfg. Co, Newark, Ohio, by use of hot spray method has resulted in a much superior paint job with a substantial reduction in amount of paint and varnish used. Varnish is heated in tank containing 2-kw immersion heaters located adjacent to spray booth. Operator can both spray handle and place it in drying racks with minimum time lost. Approximately 150 handles per hour are varnished or painted by this method.

INDUSTRIAL BRIEFS

Melting snow on canopy over entrance of new Alcoa Building, Pittsburgh, Pa. with 6.5-kw of heating cable has prevented snow build-up on canopy, eliminated possible danger to pedestrians and kept sidewalk clear. By energizing installation during snowfall, snow is melted as it falls and runs off into gutters on side of canopy. The 21 by 17-ft cantilevered canopy is aluminum topped with 4-in. concrete slab. A ⅜-in. thickness of Nu-Way Resurfacer holds the heating cable in place on top concrete slab. Aluminum metal masonry paint covers resurfacer. J. B. White, Jr., Supervisor, Industrial Sales, Duquesne Light Co, Pittsburgh, Pa.

Heating steel drums in 20-kw oven prior to painting has eliminated seri-

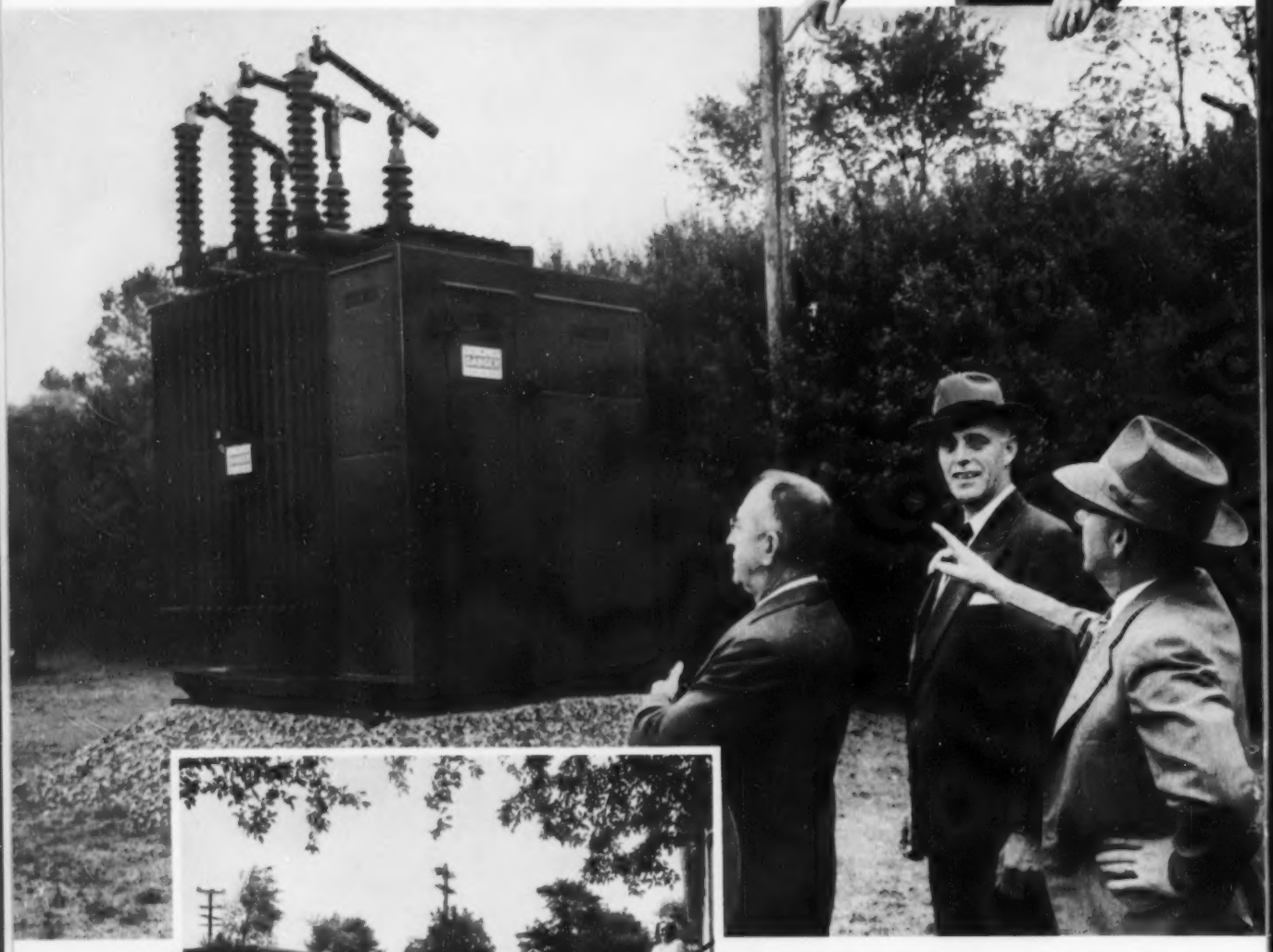
(*Continued on page* 151)

H. B. Thacker, Westinghouse Electric Utility Engineering Department, presents a group of Westinghouse engineers with their approaches to your problem of . . .

Providing maximum reliability for rural service

Harry Thacker specializes in solving distribution problems. His wide experience in all phases of power distribution stems from personal contact with utilities throughout the nation. On the following pages, he will lead a panel of Westinghouse experts discussing specific and practical ways to gain maximum reliability on rural power systems.

Let's start right at the substation . . .
Tex Brannan of the Transformer Division quotes a pioneer in the application of single-feeder unit subs for outlying areas.



Recent Substation Installation being discussed by Mr. Van Antwerp (left) and Mr. Knouse (right), both of Philadelphia Electric, and Mr. Brannan. Mr. Knouse is pointing out the clean simplicity of the station.

Contoured Design — latest advance in neatness and safety of single-feeder unit substations.

17-year record proves single-feeder unit substations meet new conditions with "better job . . . lower cost"

In 1944, Mr. G. S. Van Antwerp of the Philadelphia Electric Company, writing for publication, offered this conclusion: "The more generous use of the high tension system to reach closer to the customer, with the small-type unit substation as step-down, gives promise of meeting new conditions with a better job at lower cost."* Now, 17 years after their first substation was installed, there is ample evidence that the "promise" has been fulfilled.

While the basic fact . . . that unit substations make it easier to carry high voltage close to the load . . . remains unchanged, many of the advantages provided by Westinghouse unit substations have been vastly improved:

"Installations can be made attractive." Now a Westinghouse integral unit substation ("CSP"® Power Transformer) can be installed without overhead structures . . . even without protective fencing when leads are underground. New "contoured-design" units are outstanding for their neatness.

"Leases (of sites) can be short . . . negotiated more readily." Now it is a relatively simple matter to pick up the entire unit and move it, if necessary, because of land problems, or because of load shifts. Adjacent property owners are generally pleased with the attractive stations; consider them good neighbors.

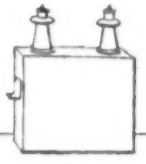
"Everything is at hand, enclosed and well-protected." Primarily, this means safety; with all live parts locked behind dead-front doors. Second, convenience; field inspection and maintenance are simplified by the ready accessibility of all parts, instruments and auxiliaries. Third, protection; the entire unit is weatherproof.

"Kept well painted — it's such an easy job." And easier than ever today with fewer offsets, plus full-length doors, to make repainting quick and simple. More than that, "Coastal Finish" and improved methods of application will eliminate the repainting problem for years.

Many electric utilities and services are modernizing distribution circuits with Westinghouse "CSP" power transformers in high-density as well as in rural locations. They alleviate such problems as flexibility, safety, real estate restrictions and regulation.

*The quotations are from an article in which Mr. Van Antwerp spoke of "unit-type transformers" generically. Westinghouse was the pioneer supplier cooperating in their development . . . leads today in outstanding advancements.

Additional ways of improving regulation are explored on the following pages.



YOU CAN BE **SURE**...IF IT'S

Westinghouse

Here's "Rusty" Campbell to tell you about an outstanding development affecting reliability of switched capacitors.*

This all-weather switched capacitor meets every service condition

Bitter cold or blistering heat — it's all the same to this Westinghouse Autotrol†. In this installation, Wisconsin Power and Light Co. gets all the benefits of automatically switched capacitors and *none* of the headaches caused by temperature extremes.

The reason: an all-weather capacitor unit developed by Westinghouse. Through coordinated design features and improvements in the Inerteen® impregnant, the working range of the new capacitor extends down to -40°F and above the industry standard of 115°F (average ambient). Its reliability and operating efficiency at these extreme temperatures have been thoroughly proved in over 3 years of field experience.

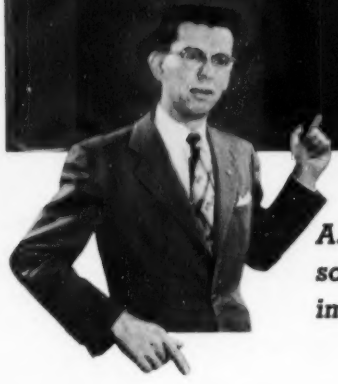
This outstanding capacitor advance entirely eliminates special capacitors for high- and low-temperature applications. Just *one* standard Westinghouse capacitor will meet every service condition on your system.

Furthermore, the Westinghouse Autotrol is the most weather-resistant capacitor bank you can buy. Racks and switches are hot-dip galvanized. Units are sprayed with molten metallic zinc. Capacitor bushings are solder sealed. You can install Autotrols and forget them — no exterior maintenance is needed.

If reactive loads in spread-out areas have been cutting down your line capacity, remember this: Westinghouse Autotrols can solve your problem at a cost of only $5.66 per kvar — far cheaper than new lines and transformers.

**Product Engineer.*
†Trade-Mark

YOU CAN BE SURE...IF IT'S Westinghouse



A. L. Cleveland, Regulator Application Engineer, says continuity of voltage level is an important part of service continuity.

Simplicity and accuracy of the URL-16 regulator increase the reliability of rural line voltage control

Westinghouse developed the URL-16 for pole and station applications, to help you solve two of your critical problems:

- **Accurate, dependable regulation**
- **Minimum maintenance**

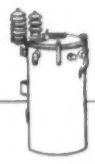
These factors have become increasingly important to service reliability, particularly in view of the increased loads imposed on rural lines today.

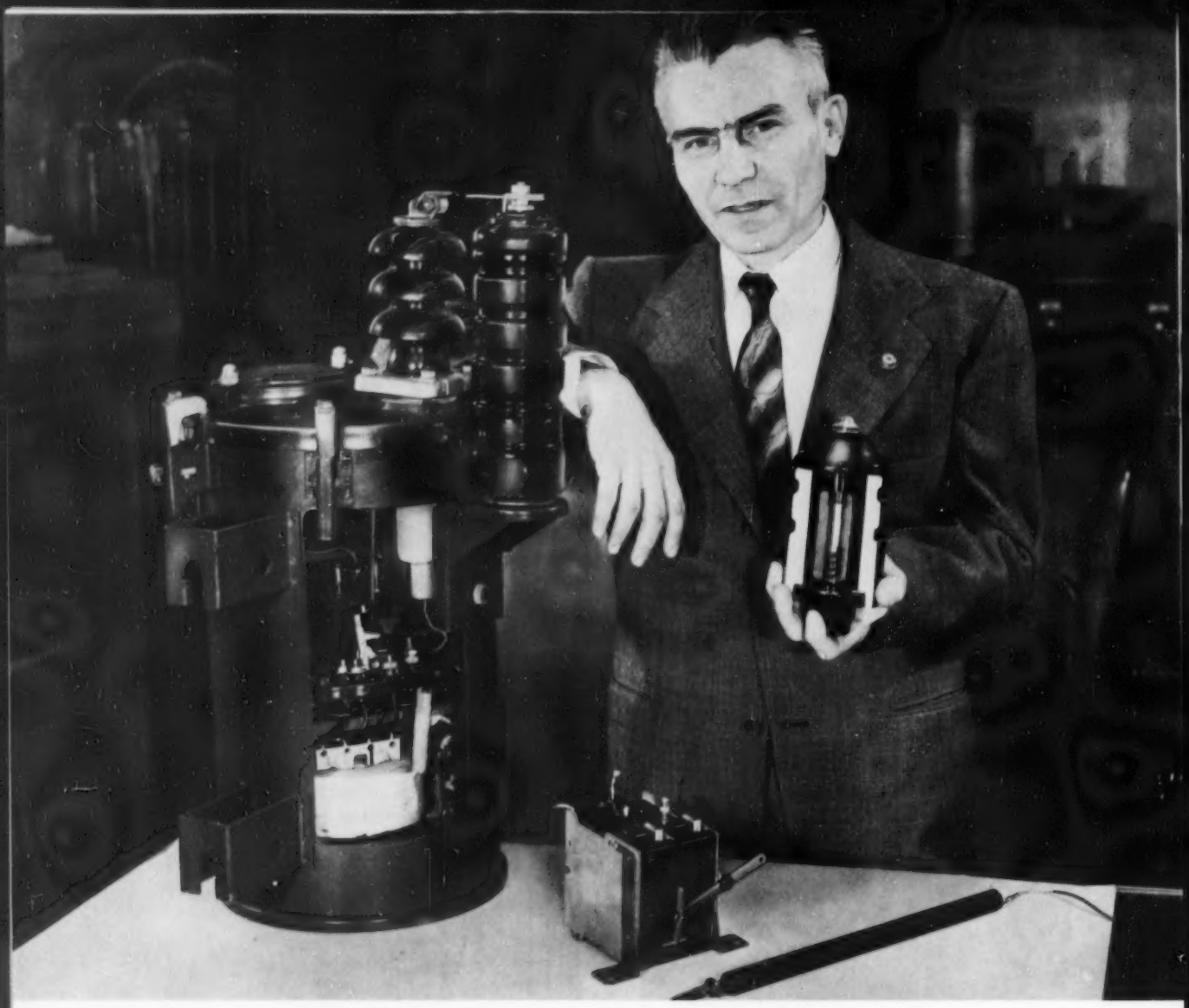
The directly driven tap changer eliminates springs, latches and shock-absorbing devices. Its Geneva gear action has smooth acceleration and deceleration, providing shockless operation with high speed during the arcing cycle. Long contact life is the natural result.

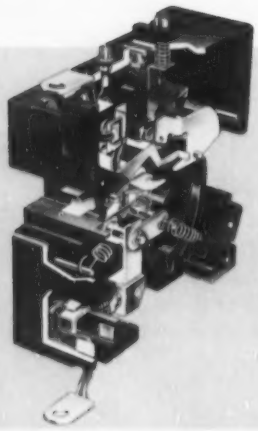
Sixteen steps cover the full range of regulation required on distribution lines. Sixteen steps also provide smooth transitions; avoid unnecessary operations and resulting wear.

The "induction-disc," voltage-regulating relay provides the correct speed of response to each individual voltage fluctuation. This relay, found only on Westinghouse URL-16's, assures accuracy with an absolute minimum number of operations.

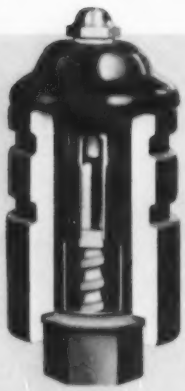
For some startling figures on the reduction of outages "CSP" transformers can make, read the next two pages.



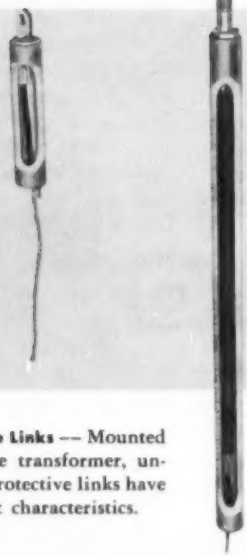




Breaker cutaway — Westinghouse "CSP" breakers are actuated by copper temperature . . . not merely oil temperature or magnitude of current.



LX-T cutaway — LX-T arrester with spiral filler has three times the power-follow current interrupting capacity of previous expulsion arresters.



Protective Links — Mounted inside the transformer, under oil, protective links have consistent characteristics.

Merrill Leonard, Section Manager of Distribution Transformer Development, makes a strong statement about rural service continuity, and backs it up with facts . . .

Factory coordination of "CSP®" devices cuts transformer outages as much as 6 to 1

That's right . . . 6 to 1; specifically, experience has proved that line crews make six times as many trips to replace fuses in conventional transformers as they do to reset "CSP" breakers.

There are good sound reasons behind that fact. They may be summarized in a single word, "coordination."

First, thermal coordination. The Westinghouse "CSP" breaker is actuated by the temperature of the copper in the transformer coil . . . not merely oil temperature or magnitude of current. This means that, unlike the fuse, the breaker "watches" the heating in the coil to protect it against the possibility of burnout, since the trip point is coordinated with the transformer thermal capability. The protective link, of course, is set to coordinate with the breaker so that its fusing point will always be above the level of the breaker operation, thus it cannot operate because of any fault on the low-voltage side.

Second, surge coordination. This is obtained first by the design of the lightning arrester to coordinate with the bushing insulation level, and the bushing, in turn, to coordinate with the insulation strength of the coils. This coordination is improved by the fact that the arrester is mounted directly on the equipment which it protects. In addition, the new LX-T arrester, through its greater power-follow current handling ability, is applicable to systems of greater power concentration.

Third, system coordination. This is made easier because the operating levels of the protective link and the breaker are set as close together as possible.

On rural lines where every trouble-shooting trip is a long, time-consuming haul, features like these are worth their weight in gold.

Now, for improved protection of conventional transformers, turn the page.

YOU CAN BE **SURE**...IF IT'S

Westinghouse

There's a new look in lightning protection. Here's Bob Innis, Distribution Apparatus Design Engineer, to tell you all about it.

More reliable lightning protection—the new LX

Note the new look of this new Westinghouse LX lightning arrester. Improved interrupter offers greater current-limiting action which gives the LX arrester the highest short-circuit rating of any expulsion arrester — 20,000 amperes at 3 kv. This rating is 100% higher than any other expulsion arrester. It means you can apply LX arresters today, with assurance that they will handle tomorrow's higher power-follow currents resulting from system growth.

Industry standards state that the short-circuit rating must be placed on the nameplate of the arrester. Westinghouse has complied with this on the new LX as follows:

3 kv – 20,000 amperes
6 kv – 16,000 amperes
9 kv – 12,000 amperes
12 kv – 6,000 amperes
15 kv – 3,000 amperes
18 kv – 1,500 amperes

The unique arc spiraling action of the LX prevents establishment of power-follow current on the majority of arrester discharges. When power current does follow, it is chopped off in a fraction of a half cycle.

Win the war against lightning on your system. Install the extra-reliable Westinghouse LX arrester.

Needed for rural service:
a reliable open cutout.
Fred Reiber* has the answer.

New . . . a simple and rugged open fuse cutout

You've never seen a sturdier, simpler cutout than this. It's the new Westinghouse DX open fuse cutout—and it offers you a degree of reliability you never had before on your distribution circuits.

The DX is reliable because it's *simple.* There's no complicated mechanism — nothing to go wrong in closing, opening, or re-fusing. When a fuse blows, the simple toggle mechanism provides fast, positive dropout. The fuse holder is easy to remove because the entire front of the cutout is open — easy to replace because top and bottom contacts align perfectly, regardless of the angle of closing.

The DX is reliable because it's *rugged.* Metal parts are clamped — not cemented — to porcelain, eliminating recesses and providing extra strength. The large-area, silver-plated contacts maintain good contact pressure. And you can say good-by to sleet troubles — large metal shields, top and bottom, completely protect the contacts.

Built to take the worst that weather and linemen can give, year after year, the Westinghouse DX is the cutout you need to boost system reliability and cut operating and maintenance costs. They are available in 5.2, 7.8 and 15-kv; interrupting capacity 2000 to 5000 amperes.

**Manager, Switchgear Distribution Apparatus Sales.*

On the following pages you'll find interesting facts about automatic protection of feeder circuits.

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Automatic protective devices must function dependably in system emergencies. Bob Lawrence, Product Engineer, tells how . . .

Safe operation and easy maintenance of reclosers and sectionalizers enhance system reliability

The rapidly expanding use of reclosers and sectionalizers is a vital factor in achieving greater reliability of service in rural areas. And of all such devices available today, Westinghouse reclosers and sectionalizers are the most dependable — for two reasons: (1) The simpler operating mechanism makes them *inherently reliable.* (2) The extraordinary safety, ease and economy with which they can be maintained encourages proper, periodic care, thus assuring dependable operation in any emergency.

High Electrical Safety Factors Protect Linemen

Westinghouse reclosers and sectionalizers are designed and built by men with years of knowledge of circuit breaker designs. Tanks are heavy drawn steel with cast-iron covers. Only one operation is required to "lock out" when closed on a fault. And to pick up a line after lock out, this one operation is time delay — rides through inrush currents without unnecessary openings.

These Features Make for Easy Maintenance

Westinghouse reclosers and sectionalizers can be inspected and maintained right in the field — they're that simple! Pliers, screw driver and crescent wrench are all that's needed. Loosening four cover clamps permits quick inspection of contacts, tank liner and oil. Painting is never required—tanks and covers are galvanized.

Replacement Kits Cut Maintenance Cost

For parts that may need replacing, Westinghouse offers easy-to-use spare parts kits. The contact kit costs only $5.61 — *cheaper by more than $13.00 than any other contact replacement.* And it takes only 5 to 10 minutes to install — less than half the time required for other makes. Tank liner and bushing kits are equally economical. Tank liner is Micarta®.

It will pay you to look over your automatic protective equipment now—*before* the lightning season strikes. For practical suggestions on recloser and sectionalizer maintenance, call your local Westinghouse representative.

Now, for a typical instance of the priceless ingredient Westinghouse offers . . . broad application experience . . . see the next page.

YOU CAN BE SURE...IF IT'S

Westinghouse

Proper coordination of protective devices means improved distribution reliability

Bob Longwell, Engineering and Service Manager, Chesapeake District, tells the story.

"A small utility in our area was having protection trouble. Loads had grown fast. The positioning and ratings of their automatic apparatus made proper coordination of protection difficult. As a result, power outages were too frequent and affected large areas.

"We had been over their system carefully — felt we knew the answer to their problems. Working closely with their engineers, we drew up a system-wide plan of coordinated reclosers, sectionalizers and fuses. Westinghouse engineers at East Pittsburgh checked and approved our proposals.

"The customer tested the plan on one-fourth of the system and was pleased with the results. Service continuity was notably improved — power outages localized. In fact, results were so encouraging that they have now carried out the plan 100%."

* * * *

Bob Longwell's story underscores this fact: It takes *more* than reliable equipment to make a reliable system — it takes skillful application engineering, too.

This priceless ingredient — born of years of experience in solving utility distribution problems — is yours through Westinghouse consulting and application engineers. There's a C&A engineer near you. He knows your distribution problems and how to solve them. And he is backed by all the engineering resources that Westinghouse commands. Contact your local Westinghouse representative for prompt C&A service.

CP-1013

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Want detailed information?

Your local Westinghouse representative will be glad to provide it. Or fill in this coupon and mail to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Gentlemen: Please send literature checked below:

- ☐ Single-Feeder Unit Substations ... DB 48-100
- ☐ Autotrol Capacitors ... DB 49-310
- ☐ URL-16 Regulators ... B-5841
- ☐ "CSP" Distribution Transformers ... DB 46-100 "CSP" DB 46-110 "CSP"
- ☐ LX Lightning Arresters ... DB 38-130
- ☐ DX Fuse Cutouts ... DB 38-620
- ☐ Reclosers and Sectionalizers ... DB 38-710 DB 38-760
- ☐ Maintenance of GR Reclosers and GRS Sectionalizers ... SA-7359

Name_____

Title_____

Company_____

Street_____

City_____ State_____

CP-1013

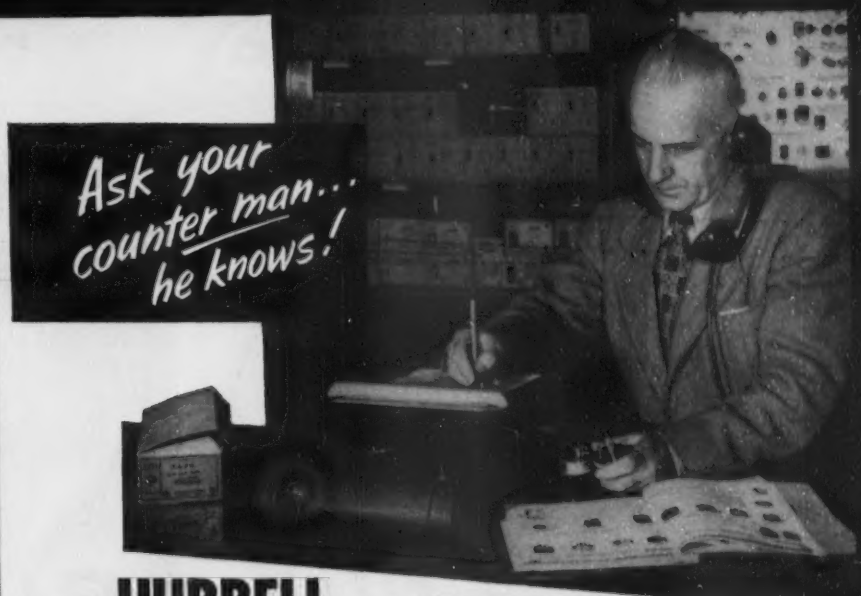
Industrial Briefs

(*Continued from page* 138)

ous paint shop bottleneck. About 50 reconditioned drums per hour can now be processed at operating cost of less than 1¢ a drum. Painting now keeps pace with other reconditioning operations and quality is better, a considerable amount of work space has been reclaimed for productive work and rejects have been reduced to practically zero. Formerly, after paint was applied, it was necessary to allow ½ day drying time before containers could be shipped. This required a large working space and unavoidable handling damaged wet paint finish. G. H. Hoffman, Industrial Power Dept, Consolidated Gas Electric Light and Power Co of Baltimore, Md.

Space heating sacking room electrically readily solved a space heating problem in otherwise unheated fertilizer plant of Ohio Farmers Grain and Supply Association, Fostoria, Ohio. A 3-kw strip heater type of space heater was installed under sacking machine providing a combination of convected and radiant heat. Since installation, operator has had no difficulty in keeping his hands and feet warm. Plant manager also states that leaving heater on at night keeps machine warm and no difficulty is experienced in starting and getting it into operation on cold mornings. R. T. Woodruff, Industrial Power Engineer, Ohio Power Co, Fostoria.

Spray painting metal products with electrostatic paint spray equipment at F. H. Lawson Co, Cincinnati, Ohio has eliminated "tear drops" and paint drips and resulted in a smoother and more even paint job. A conveyor carries cylindrical sheet metal products, such as canister sets and waste baskets, past the paint spray nozzles. Conveyor is indexed so that paint is sprayed on the metal product when it is in front of spray nozzle and is automatically shut off when the product moves out of range. A vertical wire, located in front of the spray nozzle, is energized by a high voltage 60 cycle step-up transformer to a potential above 13,200 v. This wire when energized, creates an electrostatic field which ionizes the paint particles and causes the paint to be deposited with a fine even spray. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.



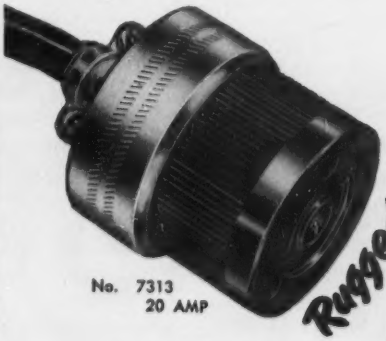
HUBBELL
Twist-Lock
TRADE-MARK
3 and 4-wire
ELECTRICAL
CONNECTORS

Check the INSIDE FACTS About Hubbell Quality

MOLDED INSERTS
Add Strength and Safety

Cross-section shows how brass inserts are molded into the base, imbedding them in the rugged composition and assuring positive "wobble-free" connections.

This is but one of many Hubbell quality features that make Twist-Lock first and still the finest with those who know.



No. 7313
20 AMP

No. 7311
20 AMP

Wherever motor driven tools or portable electrical apparatus are used, Hubbell Twist-Lock is recommended for 2, 3 or 4-wire systems . . . for increasing electrical capacity . . . safety . . . modernization, or for grounded protection.

Ask Your Distributor

Highest Grade
HEAVY DUTY
WIRING HUBBELL DEVICES

Twist-Lock 3 and 4-wire sizes are available grounded or not grounded.

HARVEY HUBBELL, Inc.
DEPT. E-2
BRIDGEPORT, CONNECTICUT

NEW EQUIPMENT

15-Amp Watthour Meter

A new 15-amp, single-phase watthour meter, Type J2, said to have a straight-line accuracy up to 100 amp is a refinement of the Type J. Disk speed of the J2 at 15 amp is 10 rpm.

Insulation has been improved. Flashover of current element at 60 cps is 5,500 v; breakdown level of potential element is 10,000 v. Insulating angles and caps of the socket-type meter's base-plate assembly have greater dielectric and impulse strength.

Bearing system has been modified for noiseless operation, increased life, and high accuracy. Grid is a strong alloy, chemically treated to resist corrosion. Damping magnet material has a higher (BH) max. product.

Other meters available in the J2 design are the 50-amp and the transformer-rated 2.5-amp meters.

Sangamo Electric Co, 11th & Converse, Springfield, Ill.

50-Amp Watthour Meter

A new 50-amp, single-phase watthour meter said to have a straightline accuracy up to 200 amp achieves its high accuracy by means of a redesigned stator. Laminations, coils, lag plate, and light-load plate are new. Current coils are assembled from die-made parts and are completely brazed. Coils are molded in butyl rubber.

The molded base of the socket-type meter has large terminals and is strengthened to withstand the forces required for insertion into a heavy-duty socket. Low temperature rises is maintained by using heavy-duty current leads and winding that have silver-plated terminal blades.

Both "A" and "S" base 50-amp meters are available. Either type of meter can be furnished with four or five dial registers.

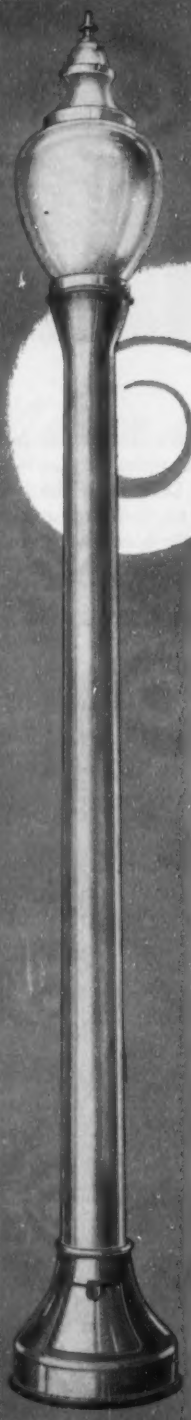
General Electric Co, 1 River Rd, Schenectady 5, N. Y.

Tool Trailer

A new light-weight, hot-line tool trailer is said to feature good roadability and rack storage space. There are four bins for accessories; rubber and felt padded racks accommodate 12-ft poles.

Floor and sides are steel. The counterbalanced aluminum-alloy lid is hinged at the front to allow unobstructed access on three sides. The trailer is 215½ in. long, 68 in. wide, 49½ in. high with lid closed, and weighs 1,150 lb empty.

James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.



FOR *Classic* BEAUTY

HAPCO PEDESTAL LAMP POSTS

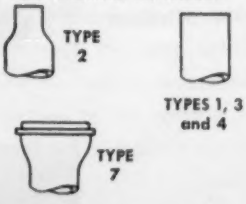
The corrosion resistant aluminum alloy used for all parts of Hapco Pedestal Poles eliminates painting and holds maintenance costs to a minimum. They weigh about one third their counterparts in steel and reduce costs of handling, trucking, and erection.

Hapco Pedestal Poles provide attractive lighting for boulevards, park roads, and institutional grounds, as well as for business and residential sections.

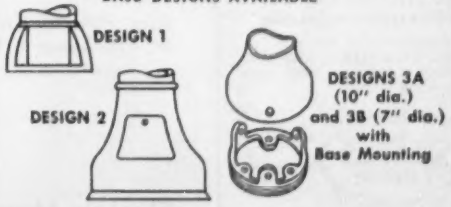
The four base designs and five types of pole tops, with heights from 6 to 14-feet, provide a wide selection. All poles are provided with 20-inch galvanized steel anchor rods. Festoon outlets are available. Type 7 top is designed to fit most globe or lantern type luminaires. Handholes will be furnished on request for Designs 1 and 3A. Designs 3A and 3B should be particularly noted for the installation feature, which involves the mounting flange used as an anchor rod template. When concrete has set, installation is completed by fitting the pedestal over the flange and inserting the three horizontal bolts from the outside.

Write for full information or refer to Linebuilder page 935.

TOP DESIGNS AVAILABLE



BASE DESIGNS AVAILABLE



HUBBARD ALUMINUM PRODUCTS COMPANY

MANUFACTURERS OF HAPCO QUALITY ALUMINUM PRODUCTS

A Division of HUBBARD and COMPANY

6301 Butler Street • Pittsburgh 1, Pa.

STATES TESTING EQUIPMENT

includes a complete line of the latest in

RELAY TESTING EQUIPMENT

Type WR
WITH FINE CURRENT CONTROL

made in two sizes:
60 amperes, 120 volts
50-25 amperes, 120-240 volts

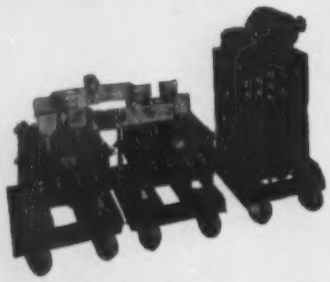
Ohm-spun

Resistance Loads

Superior for Relay Testing
Long Life, Low Cost

Controls either alternating or direct current free from distortion of wave due to inductance. Provides a light and convenient load with units designed for long life.

Current Transformer Test Outfits



PORTABLE and STATIONARY TYPES
1000 to 6000 ampere capacities

Form "CTT" Portable — 5,000 amp. capacity (2,500 amp. if one loading unit used) other forms include 2,500 and 4,000 amp. capacity single loading units

THE STATES COMPANY

Clip Off and Mail Today to

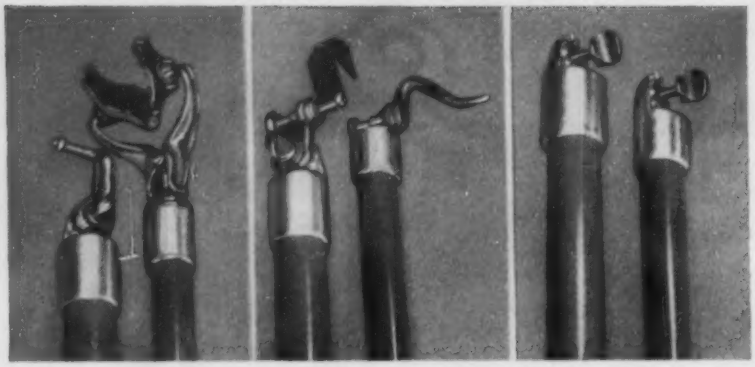
The States Company
3 New Park Ave., Hartford, Conn.

Please mail Relay Testing Cat. No. 5, Sec. 10 to:

Name ..... Title .....

Firm .....

City .....Zone....State.....



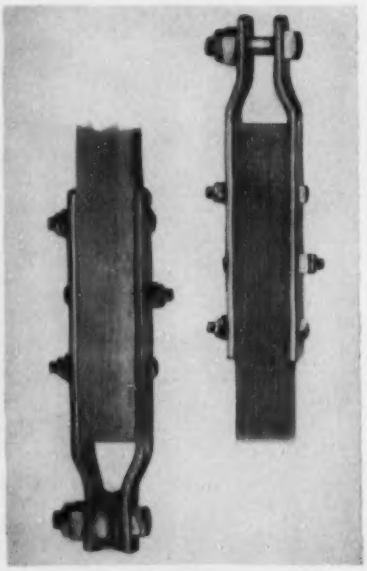
Hot Sticks

A new line of hot sticks made with laminated polyester Fiberglas tubular handles is available in the forms of wire tongs, tie sticks, cutters, universal poles, hook sticks, fuse pullers, clamp sticks, and grounding sets. They are fitted with non-absorbent plastic plugs.

Fiberglas handles have uniform physical properties including high yield and fatigue strength. Safety is said to be good because of the handle's resistance to moisture absorption, and dielectric is not sensitive to surface abrasions. Sticks are tested at 100 kv per ft for 5 min.

Bodendieck Tool Co, 325 E. Main St, Taylorville, Ill.

Wood Insulators

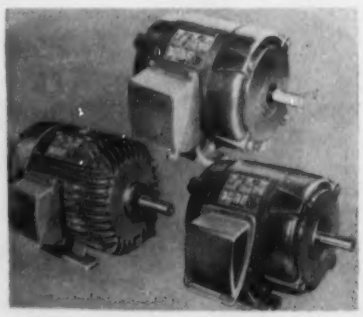


Three wood guy insulators made of mora wood, have high mechanical and electrical strengths and are resistant to decay, fire, and moisture absorption. Insulators do not have arcing horns and are designed to provide an impulse strength approximately twice the BIL of its rated voltage class.

The 15,000-lb units are for voltage classes 23 through 69 kv; the 25,000-lb models, 23 through 161 kv; and the 35,000-lb units, 69 through 161 kv. The 15,000 and 25,000 units have a single roller at one end, whereas the 35,000-lb units have two rollers side by side.

Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

Electric Motors



A new line of induction motors is avaliable as totally-enclosed fan-cooled, totally-enclosed non-ventiiated, and dripproof models. Wire insulation is a synthetic resin having high thermal endurance. Its life is said to be three times that of other in-

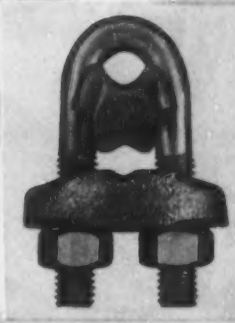
(*Continued on page* 158)

Dependable

MIF GUY CLAMPS

Never let a guy down!

- **GREATER HOLDING POWER**
  Clamping force increases as load increases. "Come-along" type grip minimizes human element in installation.
- **GREATER EASE OF INSTALLATION**
  Can be placed on strand in a matter of seconds. Holds strand in proper position while nuts are being tightened.
- **GREATER FLEXIBILITY**
  Each size accommodates a wide range of strand diameters. Substantial savings in handling and inventory.
- **GREATER ECONOMY**
  Low weight and cost per unit of holding power.



PAX67 Clamp rated 12,500 lbs. Note relative position of parts during tilting. Separating Block and Clamping Plate remain parallel at all times.

MIF UNIVERSAL CLAMPS

PAX64C accommodates 3/16"-3/8" dia. strands.

This series of clamps offers same unusual performance characteristics with added advantage of equal clamping surfaces on both wires. Particularly recommended on conductors or for general use where system standardization is desired.

SPECIFICATIONS

Cat. No.	# Rating lbs.	Strand Dia. Range	Wgt. Per C Pcs.
PAX64	7,500	3/16"-3/8"	55 lbs.
*PAX67	12,500	1/4"-1/2"	122 lbs.
*PAX64C	7,500	3/16"-3/8"	67 lbs.
PAX67C	12,500	3/16"-1/2"	142 lbs.

* Illustrated

#PAX64 & PAX64C Based on tests with nuts tightened to 45 ft./lbs.

PAX67 & PAX67C Based on tests with nuts tightened to 85 ft./lbs.

1854 ★ ONE HUNDRED YEARS ★ 1954

MALLEABLE IRON FITTINGS CO.

Pole Hardware Division Branford, Connecticut

N. Y. Office: 30 Church St.

Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd. TORONTO

Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill. • B. H. McCain, Knoxville, Tenn. • E. A. Thornwell, Inc., Atlanta, Georgia • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Calif. • L. G. Wendegats, Kansas City, Mo. • Williams Sales Co., Fort Myers, Fla. • Williamson Sales Co., Shreveport, La. • O. C. Witte Co., Detroit, Mich.

Like milady's bone-stay corset of yesteryear, which was intended to put and keep curves where they were wanted, Pinco's revolutionary new type "corset cap" for suspension insulators accomplished the same results but with a different purpose in mind.

Conforms to EEI-NEMA CLASS 52-3

Twenty-seven years ago, Pinco Engineers designed a *better* Suspension Insulator Cap. Over two hundred different types were tested—and out of this long, patient process, evolved the revolutionary PINCO CORSET CAP which is now *an accepted industry standard!*

Now, after a quarter of a century and with millions of "trouble-free" service years to its credit, the Pinco "Corset Cap" remains unchanged. And here's an important fact . . . our service records are based on the *continuous use of this design* and this design *only!* . . . proof that Pinco pioneering and Pinco quality pay off in "right-on-the-job" performance.

The advantages of this new cap were evident from the start. Its carefully rounded contours minimized the possibility of corona discharge and the new design produced a gripping effect which provided the most desirable loading of the porcelain. And last but not least, it was far stronger even though metal bulk was actually reduced!

Pinco's Corset-Type Cap design accomplishes three objectives . . . greater strength with less weight . . . a gripping effect which permits the best possible loading of the porcelain and . . . carefully rounded contours to minimize corona discharge.

ADDED "CURVES" AND STRAIGHTENED OUT A PROBLEM

Suspension Insulator Caps originally looked like this. They had a sharp, corona-creating projection which was an operational hazard and metal bulk 'way out of proportion to strength—and they did not properly load the porcelain.

If you need reliable suspension insulators, may we suggest that you consider PINCO . . . also that you try PINCO Suspension Units as replacements on your present lines. Complete information regarding these and other PINCO Insulators are available through us or the JOSLYN MFG. & SUPPLY Co. office in your locality. We invite your inquiry.

PINCO
INSULATORS
RIGHT ON THE JOB!

DO YOU HAVE A COPY OF THE PINCO CATALOG?
If not, just request one on your company letterhead and we'll be glad to mail a copy to you immediately.

The Porcelain Insulator Corporation
LIMA, N.Y.

Suspension Insulators . . . Clamps and Fittings . . . Switch and Bus Insulators . . . Distribution and High Voltage Pin Types . . . Guy and Tree Insulators . . . Special Porcelain.

No. 3 in a series discussing why ASCO* means adequacy in Automatic Transfer Switches

... why your Automatic Transfer Switch should be rated for Continuous Duty

■ IN THE NORMAL POSITION, THE TRANSFER SWITCH FEEDS THE LOAD CIRCUITS CONTINUOUSLY.

■ LIKEWISE, WHEN NORMAL POWER FAILS, AND THE LOAD IS TRANSFERRED TO EMERGENCY, THE SWITCH MAY REMAIN IN THAT POSITION INDEFINITELY.

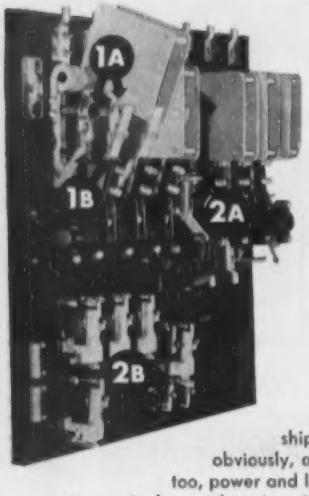
■ IN EITHER POSITION, A CONTINUOUS DUTY SWITCH IS ESSENTIAL FOR PROPER OPERATION.

NEMA DEFINITIONS

...differentiate between 8 hour devices and equipment rated for continuous duty by the following:

- Standard IC-1.51—The 8 hour rating of a magnetic contactor is the rating based on its ampere carrying capacity for 8 hours.
- Standard IC1-1.47 (Continuous Rating)—The rating which defines the load which can be carried for an unlimited time.

ASCO Automatic Transfer Switches are rated for continuous duty in accordance with IC1-1.47.



Here's why ASCO Automatic Transfer Switches can give continuous duty service:

1 Use of separate make and break contacts (1a), with separate current carrying contacts (1b), insure absolutely clean current carrying contacts at all times.

2 Momentarily energized main operating coil (2a), and low loss supervisory relays (2b), assure low cabinet air temperature

3 Low temperature rises at current carrying contacts combined with silver face surfaces insure no contact deterioration.

4 Power opening and power closing of contacts allow ample contact pressure at current carrying contacts.

In power generating stations, in subways, or aboard ship where Transfer Switches are continuously under load, obviously, a continuous rating is essential. But in industrial service, too, power and light requirements often greatly exceed 8 hours. Accordingly, good engineering practice demands a continuous duty Switch.

WRITE FOR PUBLICATION 502—FREE INFORMATIVE BOOKLET ON SELECTION OF AUTOMATIC TRANSFER SWITCHES.

ASCO Solenoid VALVES — Automatic Switch Co. — 397 LAKESIDE AVENUE ORANGE, NEW JERSEY — ASCO Electro-Magnetic CONTROLS

Motors

(*Continued from page* 154)

sulations the company had used. Coil insulation is a combination of Mylar and rag paper. Dip insulation is a phenolic-alkyd thermosetting varnish with silicone incorporated.

There are two seals on each side of the bearings—one stationary and the other rotating—to prevent entrance of foreign particles. Totally-enclosed motors are equipped with a bearing by-pass to prevent the motor from breathing through the bearing.

Ventilation of the dripproof motor is a straight through design, and splash-proof enclosures has been eliminated. Blower fan of the totally-enclosed fan-cooled motor is made of molded glass plastic. Motor frames are of cast iron. Finishes are corrosion resistant. Sound level is between 50 and 55 db.

Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.

Coming New Equipment

Received Too Late for This Issue

Earth Boring Machines

Wyoming Valley Equipment Co.—Has 10 to 20-in. augers and digs up to 9½ ft deep

Earth Digger

Acker Drill Co, Inc—Can bore holes up to 20 in. diameter and 10 ft deep

Transformer Truck

A new transformer truck, S-14, will handle transformers up to 37½ kva and some types up to 50 kva. It is

(*Continued on page* 162)

Have you a fly ash recovery problem?

Bring it to WESTERN PRECIPITATION

... The Only Organization With Years Of "Know-How" In BOTH *Electrical* And *Mechanical* Recovery Methods!

If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field . . . WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

Result:

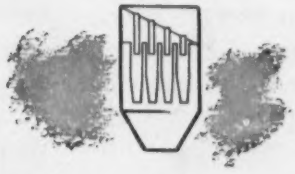
Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields . . . knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* . . . can give you a direct and unbiased recommendation on the matter . . . and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

Western Precipitation products and services include . . .

COTTRELL

Electrical Precipitators

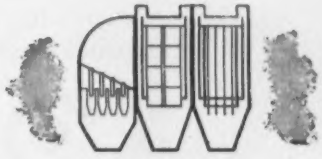
. . . the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation COTTRELLS give highest recovery at lowest cost per-year-of-service!*



MULTICLONE

Mechanical Collectors

. . . the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.



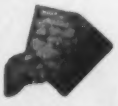
CMP UNITS

(Combination Multiclone-Precipitator)

. . . combine, in *one* compact installation, *both* mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) . . . and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!



Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

MULTICLONE—T.M. Reg.

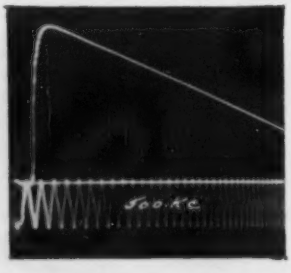
Twist of Wrist
COMPLETES CONNECTION

TURN THE CLAMPING KNOB on Allis-Chalmers new high voltage sidewall bushing to complete installation connections. It grips two standard conductors as large as No. 2 stranded cable at the same time. It eliminates splicing. Make connections from either side of bushing quickly, without tools. Its design gives complete protection against live parts.

The new sidewall bushing is supplied on Allis-Chalmers distribution transformers 167 kva and smaller, 5 kv and below. Get complete facts from your nearby Allis-Chalmers authorized dealer or district office, or write Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin.

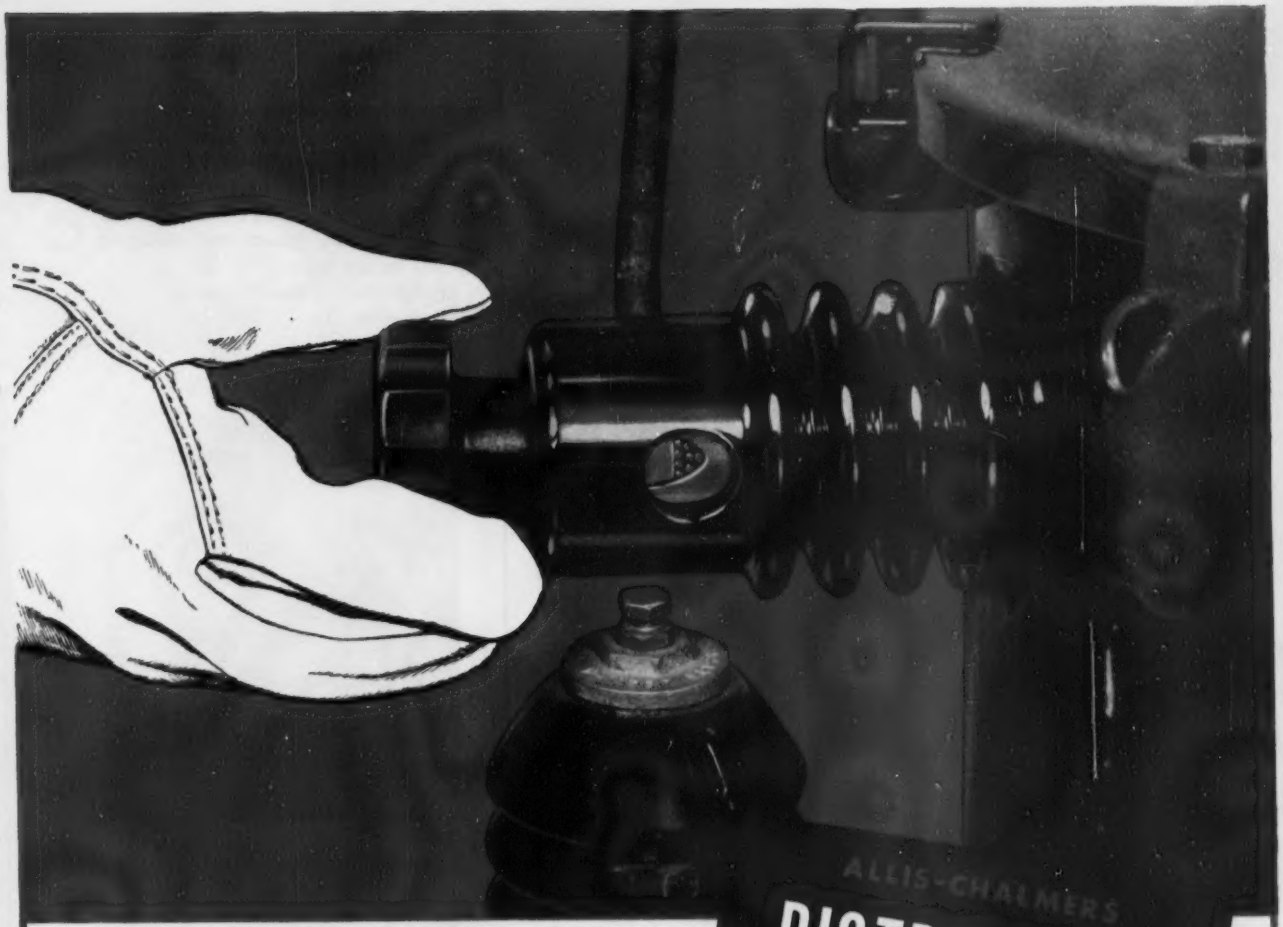
Proof of Performance for EVERY Standard Distribution Transformer

You know you get all the inherent insulation strength possible in an Allis-Chalmers distribution transformer. The oscillogram (right)—taken from a production line impulse test — proves it. It shows that all the production processes necessary to extend transformer life have been carried out. Not only distribution transformers with protective equipment, but conventional units are tested as well. This is Allis-Chalmers eighth year of production line impulse testing.



A-4345

ALLIS-



DISTRIBUTION TRANSFORMERS

FEATURES

1 Large molded phenolic clamping knob with finger-grips facilitates turning. It will not fall off, even when completely backed-off. Knob collar keeps fingers away from live parts.

2 Convex surfaced ram, actuated by knob, forces wires against the concave surface of connector body. This snubbing action locks the cable in the connector. All parts are tinned.

3 Integral bushing electrode simplifies lightning arrester installation on transformers. Gap from bushing to lightning arrester terminal removes electrical stress from the arrester except when flashover occurs.

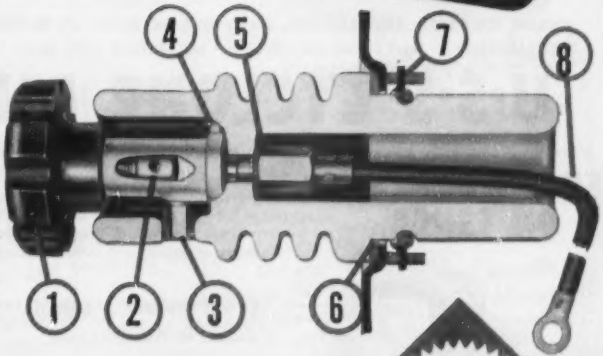
4 Connector is keyed to porcelain preventing rotation, thus protecting the gasket against twist or shear. Gasket prevents oil leakage.

5 Fibre gasket provides mechanical cushion between metal parts and porcelain.

6 Bushing is sealed in tank wall with corprene gasket. Recessed seat retains gasket for effective seal.

7 Internal clamping ring keeps bushing locked securely in place. Bolts exert even pressure on tank wall to produce uniform gasket compression. Internal ring helps simplify external maintenance.

8 Bushing cable terminates at terminal board. Easy removal simplifies routine maintenance.



CHALMERS

A-C ALLIS-CHALMERS

"Remember duh good old days when there wasn't so many Cyclone Fences?"

● No wonder these burglars are blue. Wherever they go, they are stopped cold by Cyclone Chain Link Fence.

Besides barring the way to burglars, Cyclone Fence keeps out hoodlums and other trespassers. This rugged fence also restricts employees and visitors to the use of official entrances and exits. Ingeniously designed and strongly constructed, Cyclone Fence retains its trim appearance through the years.

Send for our free booklet. After reading about Cyclone's many special features, you'll understand why so many plant executives choose Cyclone Chain Link Fence. Use the handy coupon below.

CYCLONE FENCE DEPT., AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
WAUKEGAN, ILLINOIS · SALES OFFICES COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

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Our informative booklet is filled with photographs, drawings and graphic descriptions of different styles of fence and gates for the protection of property. Whether you're interested in a few feet of fence or miles of it, you'll find this booklet worth your while. Send for your copy. It's free.

CLIP THIS COUPON — SEND IT TO

Cyclone Fence, Waukegan, Ill., Dept. V-34

Please mail me, without charge or obligation, a copy of your booklet.

Name.....

Address.....

City.....Zone....State.....

USS

UNITED STATES STEEL

Truck

(*Continued from page* 158)

well balanced, of all steel welded construction, and can be furnished with various type wheels—metal, rubber, pneumatic, etc. Transformer is hooked to the truck by means of an adjustable chain secured under any mounting hook or lid latch.

Orangeville Manufacturing Co, Orangeville, Pa.

Screw-Anchor Tool

A new screw-anchor tool is designed to slip over the pilot of any size Pengo auger. The eye of the screw or swamp anchors will slip into the other end of the tool. The tool is light and small and can be handled with one hand. It is said to be nearly indestructible.

A similar tool is also being produced for use with different makes of "A" frame diggers.

Petersen Engineering Co, Mfrs, Santa Clara, Calif.

Mobile Radio

Two radio transmitter and receiver units, FT-156 and FT-158, designed for installation in car or shop, operate in the 148-174-Mc frequency range. The FT-156 is a drawer-type, front-mount design and is said to exceed RETMA specifications for adjacent channel protection. Other features claimed include: adaptability for split-channel operation, low standby battery drain, noise lock-out through a neon-gated squelch, long-life vibrator circuit, and adaptability

SQUARE D *Reduced Voltage* STARTERS

One of these 4 types will meet your requirements . . . best

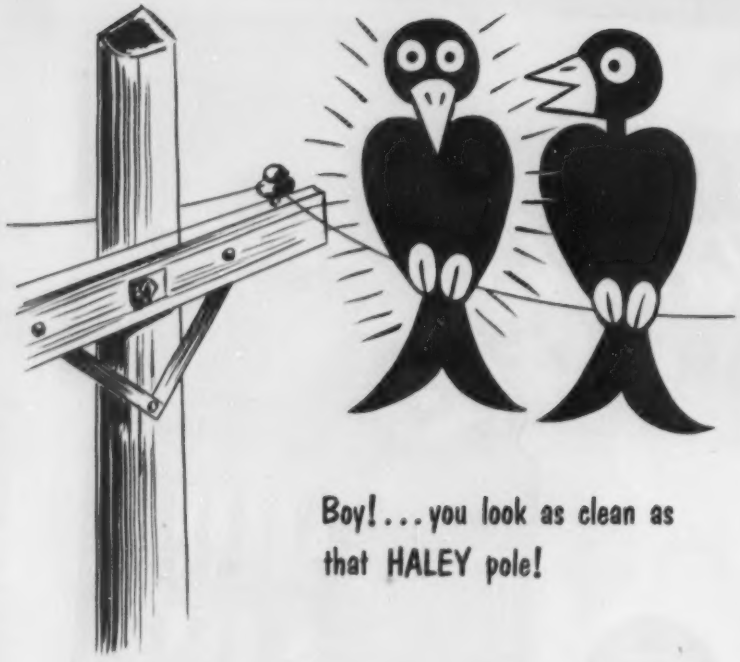
- Is minimum motor current inrush your primary consideration?
- Is it reduced starting torque? Or maximum smoothness in acceleration?
- Is cost an important factor?

With these four types Square D can meet any reduced voltage starter requirement—exactly.

Write **for Reduced Voltage Starter Bulletins. They give complete details.**
Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY



Haley's PENTAchlorophenol TREATED

CEDAR POLES
AND
FIR CROSS ARMS

Light in weight and clean. PENTAchlorophenol treated in our modern plant for protection against decay, moisture and insect damage.

TWO Strategically Located Yards
MINNEAPOLIS, MINNESOTA
FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG. TOLEDO 4, OHIO

to equipment for individual or group calling.

The FT-158 is designed for mounting any place in a flat or tilted position. Adjacent channel equipment has been engineered for split-channel requirements.

Federal Telephone and Radio Co, 100 Kingsland Rd, Clifton, N. J.

Motors

A new line of electric motors in frame sizes 182 and 184 have been designed to meet the new NEMA standards. More than 50% of the inactive space in the company's previous designs has been eliminated. Bearings are protected by a moisture-resistant labyrinth seal on the pulley end. A plug seals the short end bearing.

Windings are protected with a heat-resistant baked varnish and moisture-resistant sealer, for electrical and mechanical strength. The terminal box can be rotated 360 deg and has a tapped hole for conduit.

Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles 22, Calif.

Closed-Circuit TV

A new, compact, inexpensive, closed-circuit TV system consists of a camera, camera control, and synchronizer-monitor. It is said to provide a readable picture with no more than 2 ft-c of light.

The camera is free of external controls and adjustments are made on the remote camera control unit, which can be located up to 500 ft away. Synchronizer-monitor includes a synchronizing generator capable of producing a commercial-quality picture and a 10-in. monitor tube. All controls are on the front panel. Power input to the system is 115 v ±10%, 60 cps, 150 w.

Kalbfell Laboratories, Inc, 1090 Morena Blvd, San Diego 10, Calif.

Recorder-Controller

A new line of instruments are applicable for recording and controlling temperature, conductivity, strain,

CHANCE *KICK OUT*

the cutout designed with load break in mind

Type KO
7.5 to 15 KV
100 Amps.

Chance KO Cutouts give *unfailing protection* throughout their entire operating and interrupting range—from 10 amperes through 3000 amperes (standard Type KO), or from 10 amperes to 5000 amperes (heavy-duty Type KO-H).

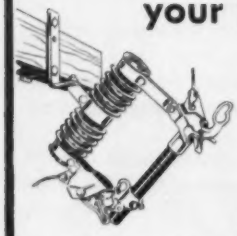
KO's gives such over-all protection because they were originally designed as a load break cutout. The load break device is eliminated when a normal cutout is desired.

The Chance KO design eliminates arcing on contacts because its 8 cycle time delay is sufficient for the arc to be interrupted *in the fuse tube* before contacts part. This means more positive arc interruption—less radio and TV interference.

Only the Chance KO gives positive, easy-to-see indication to show if the cutout was opened manually or by a protective operation.

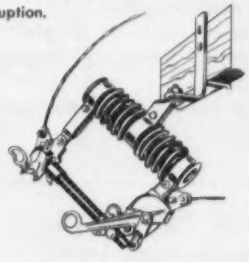
The KO also features easy opening and closing . . . fast fuse link ejection . . . easy reloading . . . and all weather operation.

A Complete line . . . for all your requirements



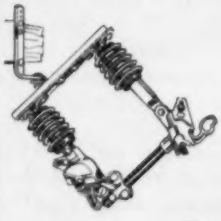
Type KO-H

Heavy-duty. 7.5 to 15 KV. 100 Amperes. 5000 Ampere Interruption.



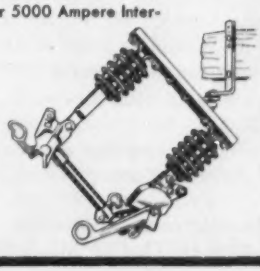
Type KO-L

The Load Break Cutout. 7.5 to 15 KV. 100 Amperes. 3000 Amp. Interruption. Also available as Type KO-HL with 5000 Amp. Interruption.



Type KO-TH

A Double Insulator Cutout. 7.5 to 15 KV. 100 Amps. 3000 or 5000 Ampere Interruption.

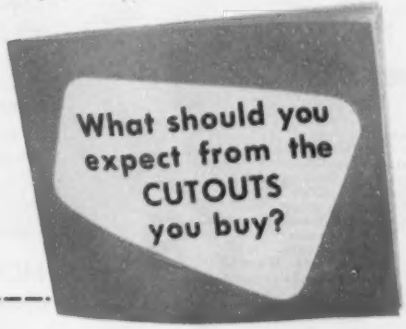


Type KO-THL

Double Insulator Load Break. 7.5 to 15 KV. 100 Amps. 3000 or 5000 Ampere Interruption.

SEND FOR THIS BULLETIN

The complete story of the Chance KO is told in the booklet "What should you expect from the CUTOUTS you buy?" Use the coupon below to get your copy of this helpful story.



A·B·CHANCE COMPANY
CENTRALIA, MO. • SAN FRANCISCO, CALIF.

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CITY_____ STATE_____

CK54–3

DOSSERT
CONNECTORS
"50 YEARS MAKE THE DIFFERENCE!"

TYPE DSU
RUGGED and DEPENDABLE

DOSULON

A one-piece bolt type variable service tap. Available in conductor sizes from 1/0 to 1000 MCM in copper or equivalent all-aluminum or ACSR cable sizes in type DSUN. Made of high strength copper alloy and equipped with silicon bronze bolts. Rugged, compact, facilitates neat taping.

● *WRITE FOR CATALOGS ON COPPER AND ALUMINUM CONNECTORS*

IMMEDIATE DELIVERY!

DOSSERT REPRESENTATIVES IN THE FOLLOWING CITIES:

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Bay City, Michigan
Boston, Massachusetts
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Cleveland, Ohio
Columbia, South Carolina
Dallas, Texas
El Paso, Texas
Kansas City, Missouri
Knoxville, Tennessee
Lakewood, Colorado
Little Rock, Arkansas
Minneapolis, Minnesota
New Orleans, Louisiana
Omaha, Nebraska
Philadelphia, Pennsylvania
Richmond, Virginia
St. Petersburg, Florida
St. Louis, Missouri
San Francisco, California
Seattle, Washington
Williamsville, New York

UL

DOSSERT MFG. CORP.
249 HURON STREET, BROOKLYN 22, N. Y.
SINCE 1904

force, position, pressure, and for telemetering. Instruments operate on the null-balance principle using an ac signal actuation and are composed of four interchangeable units.

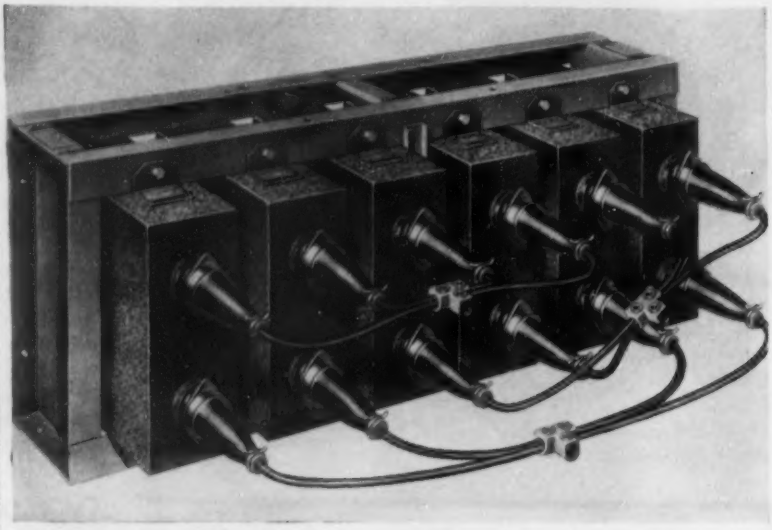
Some characteristics of the instruments are as follows: input, 35 mu v, 60 cps; input impedance, 260,000 ohms; power supply, 117v, 50/60 cps; recorded accuracy, ±0.5%.

Robertshaw-Fulton Controls Co, 2920 N. 4th St, Philadelphia 33, Pa.

Shear Cutter

A shear-type tool cuts soft copper and aluminum cables, insulated or otherwise, in sizes up to 1⅜ in. OD. It has a shear action of two, sharp, curved, passing jaws and does not flatten or crush the cable ends. Tool is for soft, non-steel metals and is not suitable for ACSR.

H. K. Porter, Inc, 6 Ashland St, Everett, Mass.



Secondary Capacitors

Completely assembled capacitor equipment ready for installation on secondary networks consists of standard outdoor capacitors, rated 13 1/3 kvar at 216 v, in a modular-type construction. Assembled units are available for 40, 80, and 120 kvar, three phase, and can be stacked three high, or otherwise, to fit available space.

Equipment is said to be completely submersible. Enclosed current-limiting fuses are terminal mounted. Capacitor units are zinc sprayed, and the frame is galvanized.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

MORE NEW PRODUCTS
about which you should know

Sensitive Research Instrument Corp, Mount Vernon, N. Y., has a **dc test set** for measuring from 1 mu amp to 60 amp and from 1 mv to 750 v . . . Vickers, Inc, 1815 Locust St, St. Louis 3, Mo., announces a self-saturating magnetic amplifier **dimmer control** for theatrical lighting systems.

Curtis Development & Manufacturing Co, 3266 N. 33rd St, Milwaukee 16, Wis., announces a line of **terminal blocks** rated at either 35 or 50 amp, 750 v, or both . . . Square D Co, 6060 Rivard St, Detroit 11, Mich., has a service-entrance circuit-breaker **load center.**

United Transformer Co, 150 Varick St, New York, N. Y., announces a 350-w **regulating transformer** to adapt electrical appliances to poor line voltages . . . Pyle-National Co, 1344 N. Kostner Ave, Chicago 51, Ill., has a 20-in., weather-tight **floodlight** that is designed for a number of lamps rated from 750 to 1,500 w.

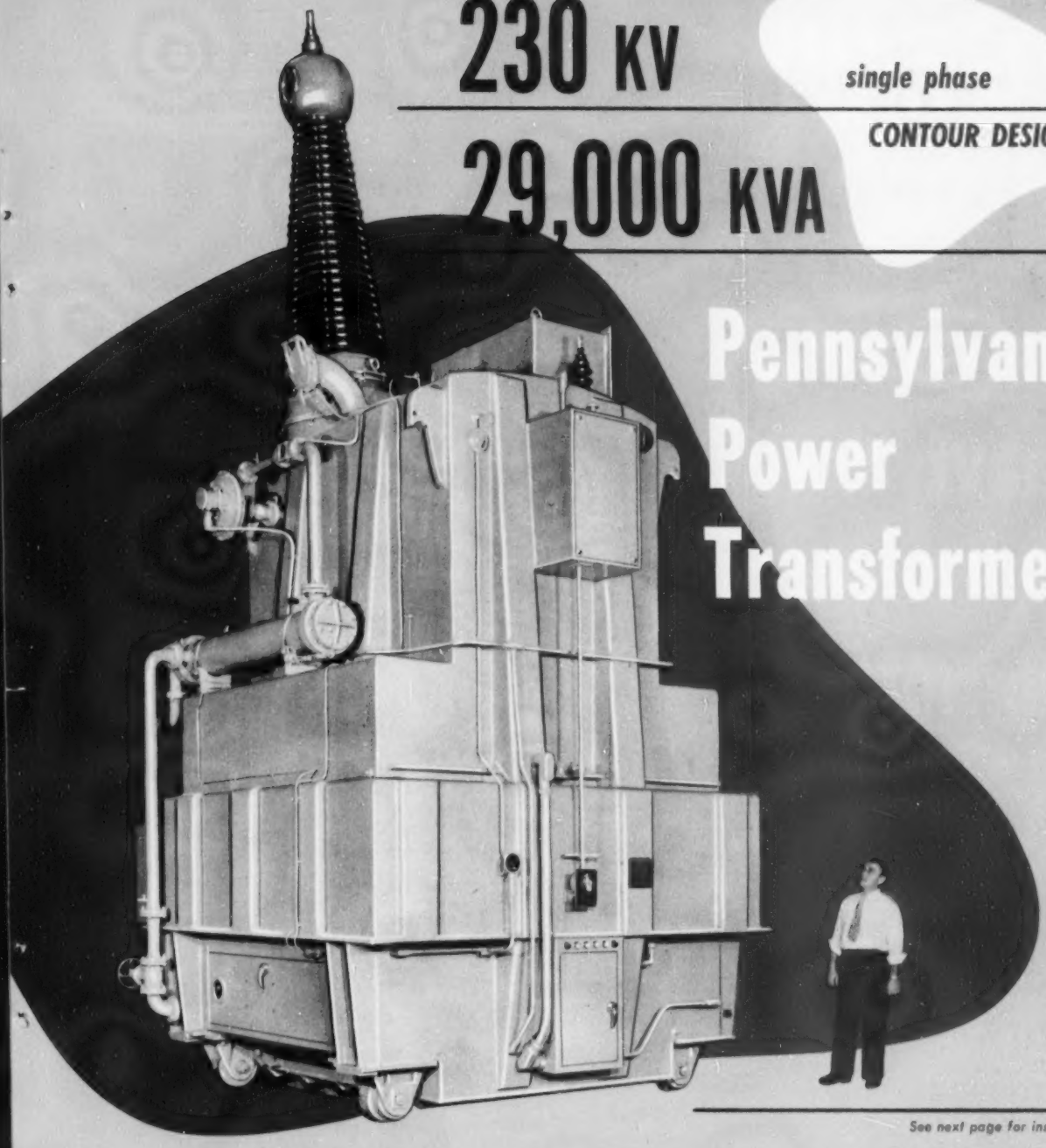
230 KV

single phase

CONTOUR DESIGN

29,000 KVA

Pennsylvania Power Transformer



See next page for inside story

Six of these shell form, Contour Design 230 Kv Pennsylvania Transformers were shipped to a power project on the West Coast to form two 87,000 Kva banks. The transformers traveled by train in an *upright position, completely assembled* except for bushings. Rated individually at 29,000 Kva, single phase, the transformers are designed to step up a generated voltage of 13,200 volts to a transmission voltage of 230,000 volts. Low operating temperatures are maintained in the transformers by means of forced-oil—forced-water heat exchangers.

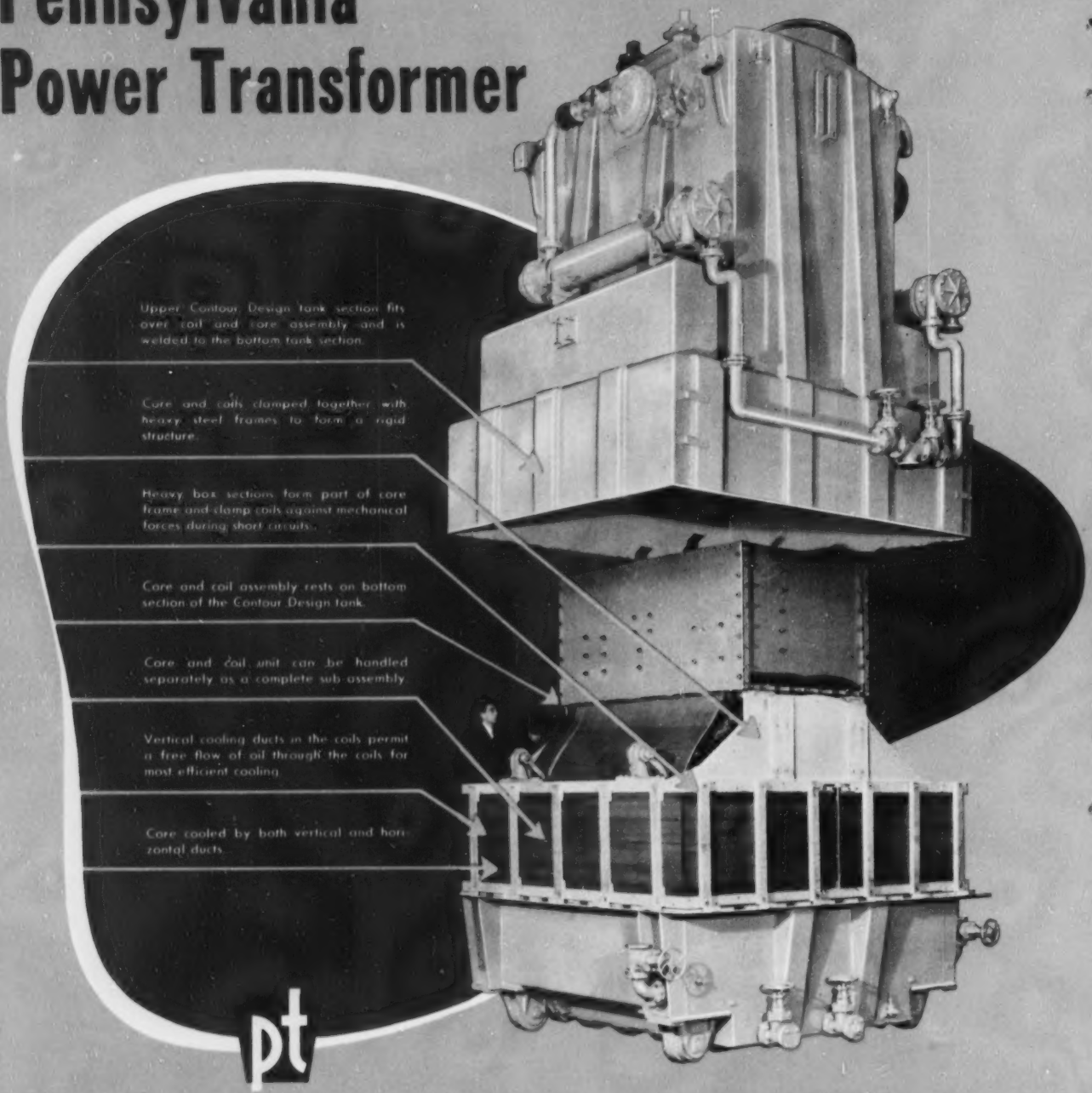
PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

Inside a 230 KV 29,000 KVA Pennsylvania Power Transformer

single phase
CONTOUR DESIGN


Upper Contour Design tank section fits over coil and core assembly and is welded to the bottom tank section.
Core and coils clamped together with heavy steel frames to form a rigid structure.
Heavy box sections form part of core frame and clamp coils against mechanical forces during short circuits.
Core and coil assembly rests on bottom section of the Contour Design tank.
Core and coil unit can be handled separately as a complete sub-assembly.
Vertical cooling ducts in the coils permit a free flow of oil through the coils for most efficient cooling.
Core cooled by both vertical and horizontal ducts.

pt

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

For exterior view of this transformer, see other side.

CATALOGS • BULLETINS

● **FLEXIBLE TUBING, COUPLINGS:** Flexible tubing, connectors, and their application for air, oil steam, gases, and volatiles are explained in an eight-page bulletin. Pennsylvania Flexible Metallic Tubing Co, 72nd St & Powers Lane, Philadelphia 42, Pa.

● **INSTRUMENTS TRANSFORMERS:** A 96-page bulletin, GEA-4626G, contains ratings, ASA accuracy classifications, and prices of a complete line of indoor and outdoor potential and current transformers. General Electric Co, 1 River Rd, Schenectady 5, N. Y.

● **INTERRUPTER SWITCH:** An eight-page bulletin discusses a quick break interrupter switch. Delta-Star Electric Division, 2437 Fulton St, Chicago 12, Ill.

● **MAGNETIC CONTACTORS:** Bulletin 502 describes various electrical switches in which the make and break action is controlled by an electro-magnet. Federal Electric Products Co, 1429 Park St, Hartford 6, Conn.

● **COPPER PLATED STEEL WIRE:** A general description of the characteristics of steel wire electroplated with copper is presented in Bulletin 201. National-Standard Co, Niles, Mich.

● **PULSE INSTRUMENTS:** A four-page brochure describes multipurpose pulse instruments. Electro-Pulse Inc, 11811 Major St, Culver City, Calif.

● **COMBUSTION CONTROL:** The application of combustion control equipment to a new boiler plant is described in Bulletin R-9. The Hayes Corp, Michigan City, Ind.

● **CONTROL INSTRUMENTS:** A 20-page publication, Catalog 2, describes process control instruments and lists a variety of flow meters, recorders, controllers, pressure regulators. Fisher & Porter Co, Hatboro, Pa.

● **INDUSTRIAL INSTRUMENTATION:** Instrumentation Data Sheet 10.0-15 describes industrial instrumentation applications of a radioactive sensitive element which permits accurate measurement of film thickness, density, specific gravity, liquid-liquid interface level concentration of alpha, beta, gamma or neutron radiation. Minneapolis-Honeywell Regulator Co, Wayne and Windrim Ave, Philadelphia 44, Pa.

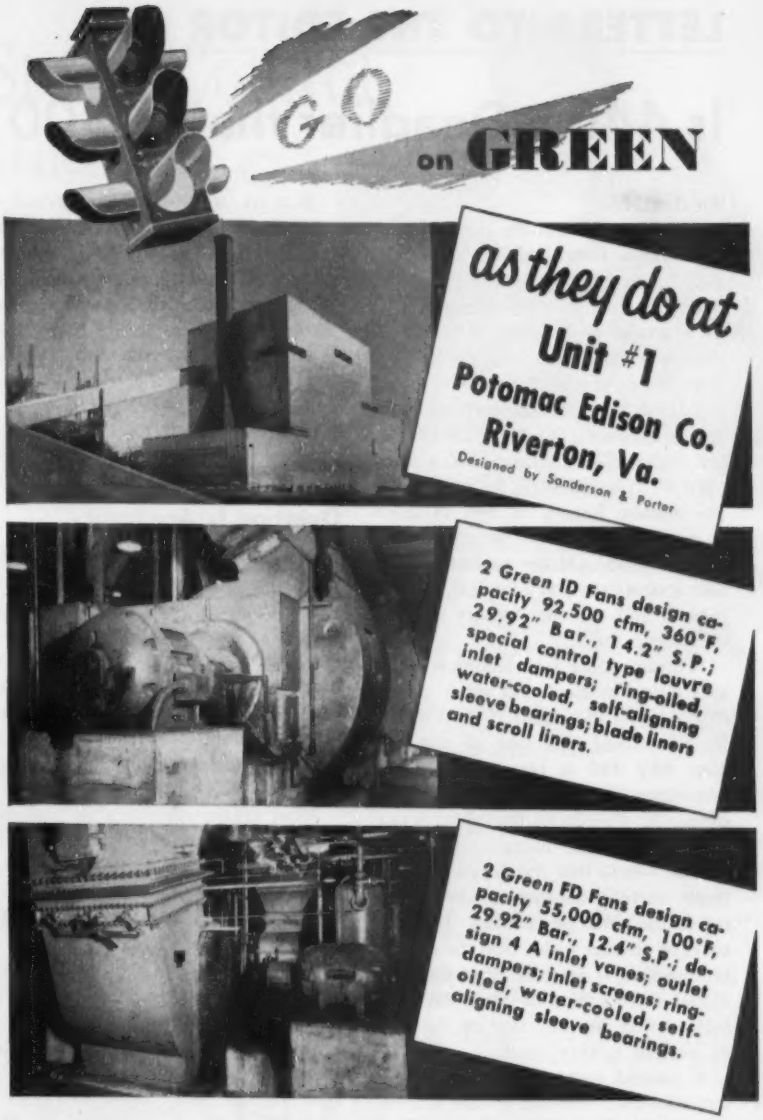
● **GENERATING PLANT:** A new 16-page edition of Power Points Digest describes various standby and mobile applications of an electric generating plant. D. W. Onan & Sons Inc, Minneapolis 14, Minn.

● **HEAT PUMP:** Explanation of the heating and cooling cycles of an all-electric heat pump is presented in a four-page bulletin including schematic flow diagrams of the refrigerant and air. Westinghouse Air Conditioning Division, 200 Readville St, Hyde Park, Boston, Mass.

● **TRENCHING EQUIPMENT:** Specifications and digging capacity of four models of trenching equipment are presented in a new bulletin. Machines cut trenches from 10 to 30 in. wide and up to 5½ ft deep. Cleveland Trencher Co, 20100 St. Clair Ave, Cleveland 17, Ohio.

● **BOBBINS:** A four-page brochure describes coil bobbins made of dielectric material. Precision Paper Tube Co, 2033 W. Charleston St, Chicago 47, Ill.

● **SERVICE MAST:** Two models of service masts one for ground and the other for roof mounting, are described in a seven-page brochure. Utility Service Co, 921 13th St, Racine, Wis.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2 Green ID Fans design capacity 92,500 cfm, 360°F, 29.92" Bar., 14.2" S.P.; special control type louvre inlet dampers; ring-oiled, water-cooled, self-aligning sleeve bearings; blade liners and scroll liners.
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The list grows—the list of utility and industrial steam generating plants for which Green Fans were selected to provide the air necessary for combustion purposes.

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BEACON 3, NEW YORK

LETTERS TO THE EDITOR

Is 440 v Deadlier than 2,300?

To the Editor:

Mr. Miller in raising a point as to the relative hazard of 440 v as compared with 2,300 in your Feb. 8 issue describes a demonstration that he gave to a group of linemen in which he demonstrated that shock current follows the principle of Ohm's law.

I think that his demonstration was valid in showing the group that Ohm's law operates with reference to a shock current. The question he raises as to the relative hazard of 440 vs 2,300 is not completely answered by this demonstration. Miller neglects to take into account the physiological, psychological, and personal factors involved in electric shock.

Without going into technical detail and citing medical and other papers that support the points, I think it can be established that one of the reasons why 440 is regarded as more hazardous than 2,300, by the group of people who do so regard it, is that a person is more likely to be "hung up" on 440 so that the duration of the shock current, another important factor in the situation, is long. In many cases of contact with 2,300 the muscular reaction is so great that the individual throws himself from the contact so that the duration of the flow of current is very brief.

A second factor that Miller does not take into account is that fibrillation of the heart is a condition that is associated with low voltage low frequency currents. A fair statement is that quite probably a number of victims of electric shock are really victims of ventricular fibrillation induced by the shock current.

The duration of the current flow and the phenomena of fibrillation may support the opinion of those who feel that 440 v is more dangerous.

As I review hundreds of electric shock accidents in the course of my work, I have developed the very clear impression that very few of them are unpreventable and that the prevention is usually reasonable and well known. By the use of available protective devices and recognized safe practices, most of the mystery surrounding electrical accidents can be removed and the accidents prevented.

I think the letter has served to stimulate some interest in this prevention which will always be an inherent responsibility of those associated with the generation, distribution, and utilization of electrical energy.

Alfred L. Dowden
Electrical Engineer
Liberty Mutual
Boston, Mass.

Question Is Academic

. . . This writer has investigated fatal accidents within a few minutes of their occurrence on 2,300 v, 13 kv and 115 kv, several cases of burns on 440 v, and has knowledge of numerous fatalities on 120 v. In my opinion the subject of "deadliness" involves many factors and cannot be answered categorically as between voltages.

Most of the resistance in a circuit made through a body is located in the points of contact and that resistance varies greatly depending on moisture and other factors. If the contacts are "right" any voltage above 100 or so is likely to be fatal. Nobody should ever "feel" voltages above 30 to see if the circuit is "hot."

Different voltages have differing effects on the muscles, the lower voltages (2,300 and below) having a greater tendency to paralyze the muscles so contact cannot be released. The higher voltages tend to cause a spasm which throws the person away from the contact. This is probably why some people believe that 440 v is more deadly than 2,300 v. My opinion is that both are very deadly but that 2,300 v is as dangerous as any voltage, higher or lower.

On 440 the circuit conditions are often such that if an arc is started by some metallic means the electrical burns to persons near the arc will be very severe. Such conditions are not as prevalent on 2,300 v circuits but this is coincidence rather than real difference in effect of voltages.

The only sure thing is that if a person makes a good contact by gripping a wire on any voltage above 100 he won't personally have to pay any more taxes.

P. G. Whitmore
General Engineer
Ebasco Services, Inc
New York, N. Y.

Not Ordinarily

. . . Mr. Miller is correct that high voltages are exceedingly more lethal than low voltages. Since Ohm's law still applies whether the shock is from high tension sources or the more conventional low voltage it is obvious from my experience that fewer men walk away from high voltage "jolts" than from the lesser voltages.

In one ten-year period with a large industry seven men died from electric shocks. Two of these accidents involved potentials below 1,000 v, the balance in the range well above that value. The average being 30,000 v. One 115-v victim showed faint, flickering heart beats during many hours of artificial respiration aided by an inhalator. None of the others developed the faintest glimmer of hope.

An oddity observed over a long period of years is that the lower ac voltages tend to freeze the victim to the circuit through the muscular contraction that occurs as the result of the cyclic current reversals. It is this hazardous condition that often causes death through continued current flow. This freezing is practically absent when high potentials are involved. In fact quite frequently the tendency is to jolt the victim free of the contact. The shock has still too frequently dealt him a lethal blow.

On the other hand the observation on low voltage direct current is that it tends to knock the contact victim free. He may be injured to a degree from the violence with which he is thrown against adjacent structures or equipment, but he is free and lives to sustain many additional dc shocks. This is especially true in mining operations where contact with the 250-v trolley wire is practically a daily occurrence.

Admitted it is, though, that the arcs developed on dc circuits, even in the low voltage categories, can be very destructive: to humans and equipment.

Paul C. Ziemke
Oak Ridge, Tenn.

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that Cuts Lathe Time and Improves Quality

Facing off a 4½" diameter dial where very smooth finish is required. The Type 1702-A Variac Motor Speed Control enables the operator to slow lathe speed as larger diameter is worked. Maintaining cutting-feet-per-second constant avoids chatter.

Variac MOTOR SPEED CONTROLS are COMPLETE units for operating DC Motors from AC Lines, and feature:

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- ★ Wide Speed Range
- ★ High Starting Torque
- ★ Rapid Starting and Stopping
- ★ Dynamic Braking

If you need a speed control which will increase the everyday versatility of your lathe and enable you to meet the most stringent production requirements . . . the Variac Motor Speed Control is the answer. This smoothly operating control makes lathe work much more efficient. In production, it enables quality work to be turned out rapidly and reliably. Variac controls are available in three sizes for 1/15th to ¾ hp motors.

LATHE OPERATORS who use these Controls REPORT THESE TIME-SAVING FEATURES:

★ *Variac Speed Controls eliminate need for changing step pulleys or gears — twist of a knob gives any speed from 5 or 10 rpm to rated*

★ *Instant Starting — no waiting for gears to mesh or engage as in mechanical controls — rapid reversing where needed*

★ *Instantaneous Braking Saves Production Time — permits sudden stops, eliminating tool overruns when under power feed or when cutting screw threads*

★ *Infinite Selection of Speeds — machine is slowed or speeded for optimum operation by flick of the wrist — in turning or facing operations, speed can be varied continuously as diameter of stock changes*

★ *Power at Few RPM — considerably more power at slow speeds makes this control invaluable in reaming and many other applications*

★ *Less Wear and Tear On Tools — speed can be set to suit material being worked or tool being used*

★ *Tapping in Slow Motion — with Variac Speed Control, lathe can be run at few rpm while tap is slowly run into drilled piece — eliminates necessity for measuring depth of drill hole on tap and carefully watching distance to which tap is advanced — motor stalling when tap is all the way in prevents tap breaking or spoiling of threads*

Type 1702-A Variac Motor Speed Control — plugs into regular 115v a-c power lines — provides continuous control of ½ and ¾ hp d-c motors — unit is completely self-contained — price $230, less motor

Variac Motor Speed Controls are amazingly efficient devices for the control of everyday machine operations including precision drilling — grinding — toroidal wire winding and screw cutting. They are time tested, highly recommended tools widely used in machine shops and large-scale factory production departments throughout the country.

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HENRY V. FABER

WILLIAM H. GIESEKE

Gulf States Appoints 4 VP's

Faber, Gieseke, Morrison, and Smith are promoted to new executive posts by Texas utility

Gulf States Utilities Co, Beaumont, Tex., has announced the election of four new vice presidents.

Newly promoted officials include Henry V. Faber, treasurer; William H. Gieseke, secretary; John J. Morrison, assistant to the president; and L. V. Smith, assistant secretary and assistant treasurer.

Faber was associated with Savannah Electric & Power Co before going to Gulf States in 1934 to assume his present duties as treasurer, which he will continue to handle.

Served Parent Firm . . . Gieseke, who started his utility career with Houston Electric Co in the twenties, served for a number of years with Gulf States' parent, Engineers Public Service Co, as a staff accountant. When Gulf States became an independent company in 1947, he left the supervisory organization to become secretary of Gulf States.

Morrison, an electrical engineer, worked with Savannah E&P before going in 1937 to Engineers Public Service, which he served for ten years as a utility analyst. When Gulf States assumed an independent status, Morrison became assistant to the president.

Smith joined Gulf States in 1927, serving as assistant treasurer until 1930 when he was appointed treasurer of Baton Rouge Electric Co. In 1933 he was employed by Western Public Service Co as treasurer, returning to Baton Rouge Electric a year later. In 1938 when Baton Rouge Electric was consolidated with Gulf States, Smith was made assistant secretary and assistant treasurer, posts he will continue to fill.

JOHN J. MORRISON

L. V. SMITH

Executive Changes Made by Electrical Engineers

Electrical Engineers Equipment Co, Melrose Park, Ill., has announced the promotions of three executive engineers.

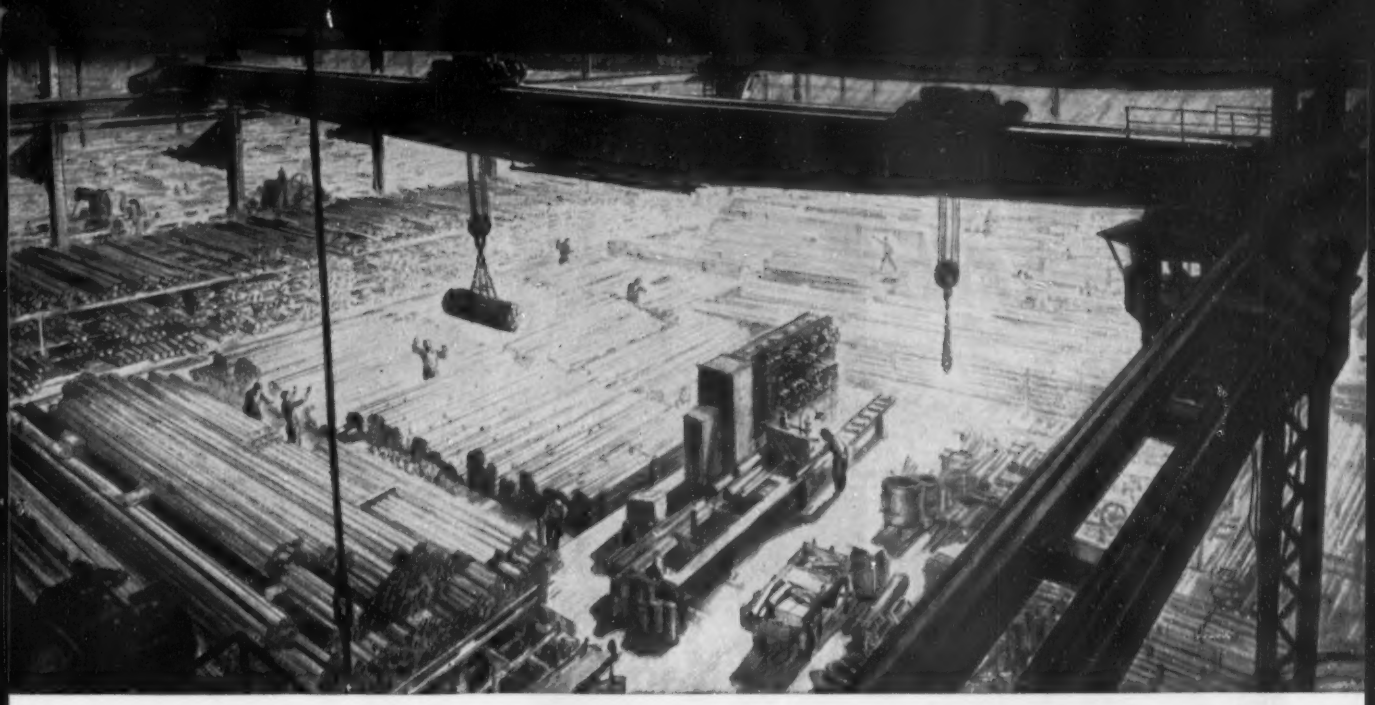
Chris Christensen was advanced to vice president in charge of engineering. Formerly chief engineer, Christensen became associated with the equipment firm in 1917.

C. A. Koerner was promoted to chief engineer. Active in the high voltage switchgear field since 1925, Koerner formerly was assistant chief engineer. Arthur Reynolds was elevated to sales promotion manager following the retirement of R. T. Calloway.

•

Leonard G. Walker has been promoted to power utility product engineer and acting product manager of the Communications and Electronics Division of Motorola, Inc. In another appointment, **Lloyd P. Morris** was made chief engineer of Motorola's new National Radio Systems Consulting Service. Walker, formerly chief systems engineer for power utility products, was electrical engineer for Idaho Power Co before joining Motorola in 1951. Morris joined Motorola in 1940 and has served as chief systems engineer since 1947.

P. A. Dunkleberger, assistant manager of Northwestern Electric Cooperative, Inc, Woodward, Okla., has been made manager of the Kiwash Electric Cooperative, Inc, which is located at Cordell, Okla.



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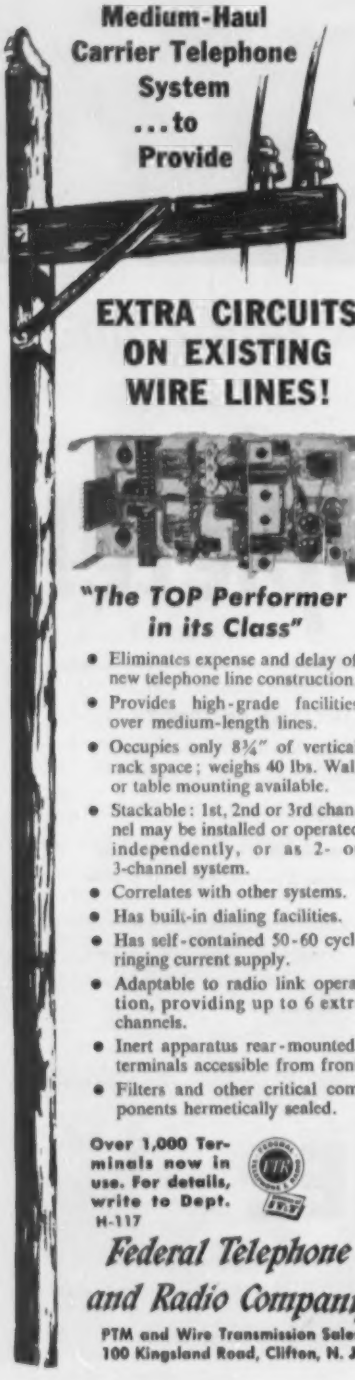

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R. W. HURD

D. M. KAMMERT

Hurd, Kammert Made VP's . . .

. . . of West Penn Power Co. The Pittsburgh utility also promoted R. G. MacDonald to general services managership

West Penn Power Co has announced the election of R. W. Hurd and D. M. Kammert as vice presidents and the promotion of R. G. MacDonald to the newly created position of manager of general services.

Hurd, advanced from assistant vice president, will supervise division and district operations and related staff activities.

Kammert, who was elected vice president and comptroller and a director, will supervise West Penn's financial, accounting, treasury, and related operations.

MacDonald, promoted from assistant vice president, will include in his new responsibilities the utility's various service functions, operation of its general headquarters, and other building, purchasing, and real estate operations.

Served as District Manager . . . A 26-year veteran with the utility, Hurd joined West Penn in 1927 following his graduation from Carnegie Institute of Technology. From 1928 until 1948, he served successively as assistant district manager at Butler and New Kensington and as district manager at Clarion, Scottdale, Ridgway, and Charleroi.

In 1948, Hurd was elevated to Western Division manager at Washington, moving later to Kittanning as Northern Division manager. In December, 1952, he was promoted to assistant to the president and joined the headquarters staff at Pittsburgh. Last May he was appointed assistant vice president.

Filled Financial Posts . . . Kammert, who was graduated from the University of Illinois in 1932, has filled numerous utility financial positions. After ten years with Illinois Power & Light Co and other subsidiaries of North American Co, he joined West Penn Electric Co, parent of West Penn Power, as assistant to the comptroller.

Three years later he added the responsibilities of assistant secretary and assistant treasurer of West Penn Power, and in 1948 was made assistant comptroller of West Penn Electric. He joined West Penn Power's Pittsburgh headquarters staff as comptroller in 1951.

MacDonald started with West Penn in 1931 at Butler, later becoming assistant division line superintendent at Kittanning. In 1936 he joined the general headquarters staff at Pittsburgh as assistant personnel director.

After that MacDonald served as assistant line superintendent at Kittanning, district manager at Bellefonte, advancing in 1946 to Keystone Division manager. In 1952 he returned to Pittsburgh as assistant to the vice president and a year later was promoted to assistant vice president.

CHARLES L. STROUP

Elevated to Vice President

Charles L. Stroup, chief engineer for Hubbard & Co, Pittsburgh, Pa., has been named vice president in charge of research. His headquarters will continue to be at the Chicago plant, where he has been since joining the company in 1940. Stroup is a graduate of Louisiana State University.

•

Alton E. Alspaugh, a civilian engineer with the Army Corps of Engineers since 1939, has resigned to join the engineering staff of Pacific Power & Light Co to serve as hydroelectric development engineer. Alspaugh had been employed by the Corps on the Bonneville Dam project, at the Walla Walla (Wash.) district office, and the North Pacific Division in Portland.

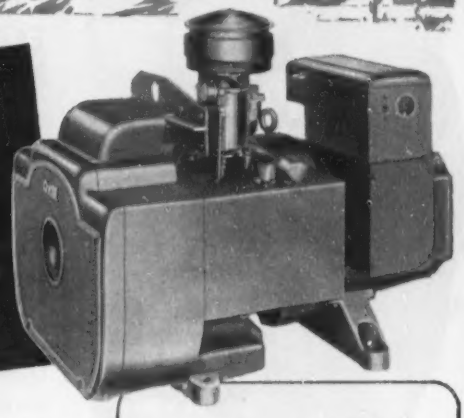
Claude L. Matthews, vice president of A. B. Chance Co, has been named a director of the Centralia, Mo., company. Matthews, originator and donor of the Claude L. Matthews Valor Awards to utility employees, was president of W. N. Matthews Corp, St. Louis, until its purchase last April by Chance.

W. A. Blees has resigned as a vice president of Avco Manufacturing Corp. Blees, however, will continue to serve Avco as a consultant.

William C. Rowland, a vice president of Westinghouse Electric Corp and a former head of the company's Manufacturing and Repair Division, has been assigned responsibility for the

Forging Stronger Links in Microwave Relay

ONAN STANDBY ELECTRIC PLANTS



Microwave transmission is only as dependable as each of its relay links. If one repeater station cannot operate, messages do not get through.

To assure electric power for transmission, hundreds of microwave relay stations across the country are equipped with Onan Standby Electric Plants. When central station power is interrupted, the Onan plant starts automatically, supplies power for as long as the emergency lasts, then stops automatically. Controls are available to provide a time interval between power interruption and starting.

Onan Standby Electric Plants have been proved indispensable in installations serving oil and gas pipelines, utilities, railroads, TV networks, police and other government law enforcement departments.

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5,000 watts A.C.

Air-cooled, gasoline-powered

- **COMPACT**—Take less than one cubic yard of space. Easier to install. Connection box provided for quick hook-up.
- **UNI-DUCT COOLING**—Cooling air is drawn by vacuum through generator and over engine. All heated air is expelled through one small vent which also discharges engine exhaust. Quiet operating. No liquid coolants to freeze or leak.
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A size and model for every standby application!

3,500 watts A.C.
2-cyl. air-cooled

10,000 watts A.C.
2-cyl., air-cooled

5 to 35 KW A.C.
Water-cooled

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S. E. OVERTON COMPANY
SOUTH HAVEN, MICHIGAN

Steam Division, South Philadelphia, Pa. Succeeding Rowland as manager of the M&R Division and its 40 plants throughout the country is **Chris H. Bartlett,** formerly assistant manager of Westinghouse's Transformer Division, Sharon, Pa. In another appointment, **Ray H. Timmons** was made works manager of the Steam Division, reporting to Rowland. Before transferring to the Steam Division in 1952, Timmons was for three years manager of manufacturing for all Industrial Products Divisions.

EERA Elects R. A. Kent as Its New President

Electrical Equipment Representatives Association has elected the following new officers:

Richard A. Kent of the Richard A. Kent Company was named president to succeed Earl S. Condon. Other officers included Howard Peterson, Peterson Co, executive vice president; E. W. Verbarg, Bergstrom-Verbarg Co, second vice president; Marvin Horne, George R. Horne Co, secretary; and C. E. Reed, Lyman C. Reed Co, treasurer.

The association also elected two new directors. They are C. B. Broschart, for 1954, and G. E. Honn for 1954-55.

•

L. R. Douglass, director of power of the Bureau of Reclamation's Boulder Canyon Project, will retire from federal service on March 31 after a 21-year career as a Reclamation engineer and administrator. Douglass has been in immediate charge of Hoover Dam and power plant since 1950. He went to Boulder City, Nev., in 1944 as assistant regional director of the bureau's Region 3, then being organized.

Troy T. Murray has been named a member of the Massachusetts Department of Public Utilities to succeed **Edward L. Ford.**

Mildred Morrissey has been elected assistant secretary of Northern States Power Co. Miss Morrissey, first woman to hold an official position with Northern States, joined the company in 1925. For the past several years, she has worked closely with E. G. Kellett, NSP's secretary.

OBITUARY

Robert G. Ely

Robert G. Ely, vice president in charge of sales for Connecticut Light & Power Co, died at Farmington, Conn., Feb. 20.

Active in utility sales work for 25 years, Ely was named director of sales for the utility in 1951, and was elected vice president in charge of sales a year later. Before joining Connecticut L&P three years ago, he had been assistant manager of industrial power sales for Public Service Electric & Gas Co, Newark, N. J.

Ely was a member of the Rate Research Committee of Edison Electric Institute and chairman of the Connecticut Farm Electrification Council. For the past year he had been chairman of the New England Farm Electric Service Committee of the New England Council.

R. E. Fisher

R. E. Fisher, 71, vice president of public relations and sales for Pacific Gas & Electric Co until his retirement in 1947, died Feb. 12 at Piedmont, Calif. Fisher, who helped found numerous electrical associations in the West, received the 1937 James H. McGraw Award for Electrical Men for "distinguished contributions to the electrical industry."

A graduate of the Van der Nailen School of Engineering in San Francisco, he served with General Electric Co and Pacific States Electric Co in San Francisco before joining PG&E in 1911 as a power salesman. He became manager of the commercial de-

partment in 1918 and in 1922 was made vice president of public relations and sales. Following his retirement in 1947 he served on an Economic Cooperation Administration mission charged with developing electrical power in Italy. Upon his return to San Francisco he became a power consultant to Bechtel Corp, serving in that capacity until his death.

Fisher was a past president of the Pacific Coast Electrical Association.

Walter H. Ferguson, manager of the customer service department of Duquesne Light Co, died Feb. 14. Affiliated with Duquesne Light since 1922, he was appointed manager of retail service in 1943 after having served as director of district service and director of district retail service for several years. He was active in the Pennsylvania Electric Association and Electric League of Western Pennsylvania.

T. Barclay Whitson, 59, director of engineering and a member of the board of James G. Biddle Co, Philadelphia, died recently. He joined the Biddle firm in 1922.

H. A. Van Norman, 75, retired general manager and chief engineer of the Los Angeles (Calif.) Department of Water and Power, died recently. Van Norman, who joined the department in 1907, was appointed to the executive posts a year prior to his retirement in 1944.

Francis E. Frothingham, 83, retired utility executive and investment banker, died Feb. 12 at Cannan, N. H. Nationally recognized as a utility securities expert, he was in charge of the Bellingham Electric Co's business 35 years ago prior to its absorption by Puget Sound Power & Light Co. In addition to serving for a number of years as vice president of Coffin & Burr, Inc, Boston, Frothingham was affiliated with Stone & Webster Corp and Whatcom County (Wash.) Railway & Light Co.

Herbert J. Scruton, 68, who retired three years ago as superintendent of generation, transmission and distribution for the Eastern Division of Niagara Mohawk Power Corp, died recently in Albany, N. Y. For the past two years he had served the utility as a special consultant.

NOW-A Better Tap Connector THAT'S EASIER TO USE YET COSTS LESS!

the New IDEAL Tap Connector

The all-new IDEAL Tap Connector is the first big improvement in tap connectors in many years.

Its unique design not only gives *greater* mechanical strength — more contact area and more pressure, but also keeps the connector under constant spring tension. As a result contacts are better, wires can't work loose and "burnouts" are practically eliminated.

Easier to Use!

JUST ONE UNIT!

No Parts to come loose

Easier to Stock!

ONLY THREE SIZES are needed for all combinations from two No.1 wires to one No.10 and one No. 12 or one No. 8 and one No. 14. Connectors are available *without* spacer bars for copper-to-copper or aluminum-to-aluminum, *with* spacer bars for copper-to-aluminum, copper-to-steel or aluminum-to-steel.

Costs Less!

The IDEAL Tap Connector is lower in price than other connectors for practically every combination.

Sold Through Leading Distributors

Ask To See It!

Or mail coupon for full data—how you can save money and have better tap connections!

IDEAL INDUSTRIES, Inc.
1021 Park Avenue, Sycamore, Illinois
Please send catalog data on IDEAL Tap Connectors

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Progress Payments Analyzed

GE's Huether considers subject at parley of Public Utility Buyers' Group of National Association of Purchasing Agents

Proposals on handling capital investments and progressive payments were offered by J. J. Huether of General Electric Co at the 23rd annual mid-winter conference of the Public Utility Buyers' Group of the National Association of Purchasing Agents held last month at Lord Baltimore Hotel, Baltimore.

The meeting featured talks on bituminous coal, aluminum, steel, and copper. A panel discussion on the economic situation was also held. Participants in that session included Fischer Black, editor, Electrical World; Kenneth Kramer, executive editor, Business Week; and H. W. Springborn, executive editor, Gas Age.

Capital Investments . . . In his talk at the panel discussion on progressive payments, Huether, who is manager of the sales department in GE's Apparatus Sales Division, said the utility industry can, in the long run, get lower prices if it recognizes the job to be done by the manufacturer in handling his capital investments. On this basis, he added, the measuring stick used by GE in evaluating the performance of each of its product departments is the percentage earned on capital investment.

To illustrate this he reviewed GE's position on payments.

Huether, who made it clear that he was not a spokesman for the industry or any of the electrical manufacturers, pointed out that like most machinery manufacturers, GE measured the economic value of individual products against their actual manufacturing costs. Therefore, Huether continued, GE has used for many years separate cost reduction programs on all of its major lines of products. One of the important elements in each of these cost reduction and cost evaluation programs is the financing of each of the product lines as a separately financed business.

General Electric continues to be low in cash resources, and uses less cash in operations than any comparable company in the country, he said. Despite the necessity of maintaining 1,100 bank accounts in 350 banks, he said, GE operates with aggregate balances of about $60 million and obtains a cash turnover of 120 times a year. To the operating components, he asserted, this means lower investment and to the purchaser of GE products, lower prices and substantial earnings to GE from investment of temporarily idle funds.

Progressive Payments . . . Huether pointed out that progress collections, which were $400 million last November, continue to be the largest single factor in financing GE's operations. Progress payments are defined as payments made by purchasers to suppliers of equipment prior to purchaser's receipt or vendor's shipment of the equipment to cover the vendor's cost of producing the equipment as the costs accrue to him.

Four basic principles are used by General Electric in making its small cash balances possible and in getting the most out of the money received from the government and utilities in progress collections. Here are the basic principles:

1. Bank balances at GE's widely scattered plant and sales office locations kept to minimum size.
2. Concentration of major collections and disbursements at operating division headquarters.
3. Pooling in corporate reserve accounts in a few major metropolitan banks the excess funds of all operating units and affiliates.
4. Use of most advanced techniques for moving bank balances to points

Pennsylvania Transformer Has a Birthday

Pennsylvania Transformer Co celebrated its 25th anniversary last month in a setting that combined a circus touch with the more formal dinner atmosphere customary to such occasions. A total of 142 long-term employees were presented gifts to commemorate their years of service with the company. Included were six, who had been with the firm since its founding in 1929. The picture shows Samuel Horelick, left, co-founder of the company, looking on as Bill Kerr, president, cuts a birthday cake—topped by a reproduction of a 230 kv, 29,000 kva unit that was manufactured by the company.

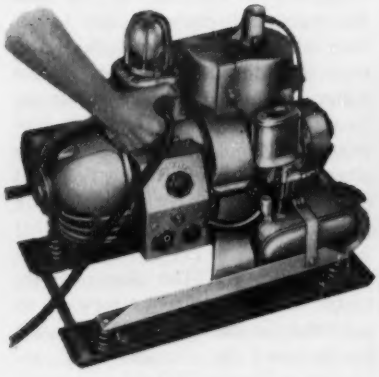
HANDY UTILITY

for Public Utilities

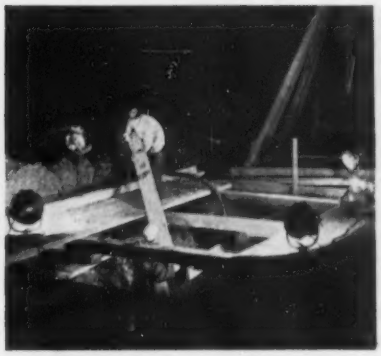
Day and night, there's always a job for a Homelite. You use it for floodlights. You use it for power tools. You use it for standby emergency power. Yes and you use it anyplace . . . *everyplace.*

Small and compact, a Homelite stows away neatly in your truck. Light in weight, one man can pick it up and put it in operation quickly. And famous for its dependability, a Homelite gives you quick-starting and continuous trouble-free performance in all kinds of weather . . . hot, cold or wet.

Write for a free demonstration.



During power failures due to storms or accidents, simply plug into a Homelite, for emergency power requirements.



On night repairs, brilliant floodlights operated by Homelite Generators speed work, save time, save money.

On day repairs, electric power tools operated by Homelite Generators speed work, save time, save money.

Manufacturers of Homelite
Carryable Pumps • Generators
Blowers • Chain Saws

PERFORMANCE · DEPENDABILITY · SERVICE

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CORPORATION

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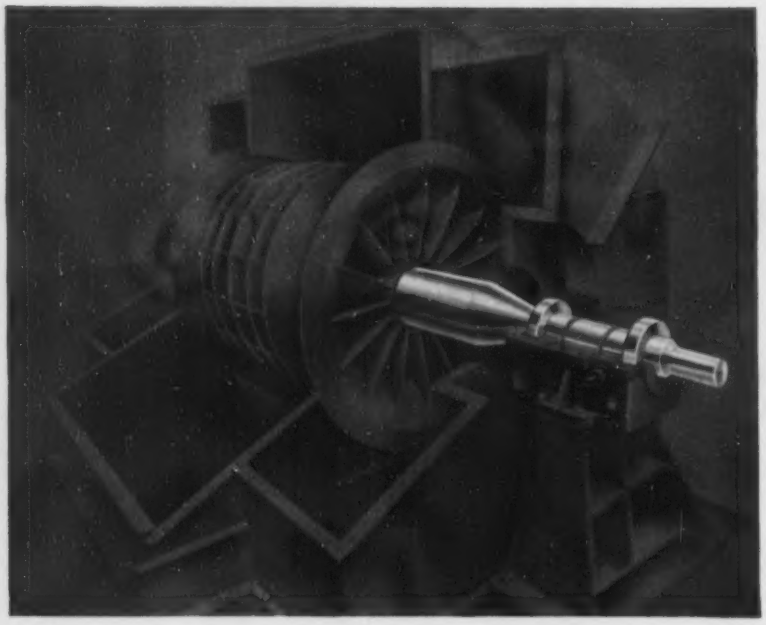
Canadian Distributors: Terry Machinery Co., Ltd., Toronto, Montreal, Vancouver, Ottawa.

How a FAN SHAFT Turns Out CHEAPER POWER



. . . in "Buffalo" Induced Draft Fans

This "Buffalo" Shaft is about to start saving money on a punishing draft job, because it's built for "no-time-out" service! Forged, annealed and precision-ground from a single solid piece of steel, it is oversize, so that its critical speed is well above highest operating speed. Note the substantial thrust collars, ground to fit the bearing very closely. Note the extra-heavy center portion which will bear the rotor. Here, certainly, is shaft construction to stand all the stresses and heat of high-pressure draft service indefinitely. And there's the same long-life toughness in all other parts of "Buffalo" Induced Draft Fans — the money-saving "Q" Factor — described fully in Bulletin 3750. Write for your copy today!

The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.

"Buffalo"

BUFFALO FORGE COMPANY

212 MORTIMER STREET BUFFALO, NEW YORK

Publishers of "Fan Engineering" Handbook

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

where funds are required.

In addition to Huether, the panel heard R. H. Sperreng, Union Electric Co of Missouri; and R. M. Casper, Allis-Chalmers Manufacturing Co, discuss prices. The subject of escalation was discussed by George H. Cole, Alabama Power Co, and H. G. Ebdon, vice president, Combustion Engineering, Inc. Progressive payments were also analyzed by J. Donald Hogg, Cleveland Electric Illuminating Co.

A good portion of the conference was devoted to talks on coal and metal markets.

Bituminous Coal . . . To emphasize the importance of the utility industry as a buyer of coal, George H. Love, president, Pittsburgh Consolidation Coal, Inc, said that utilities now buy 50% of steam commercial coal as compared with 10% in 1940.

In estimating that utility requirements may double by 1965, Love said that industry will need 50% more fuel. Such purchases, Love, noted, warrant an ever increasing responsibility by utilities to try to keep the coal industry strong.

For the benefit of both industries, Love asked the utilities to consider seriously negotiations of long term arrangements for at least two-thirds of industry coal needs. The arrangements should not be for less than 10 years and probably not longer than 20. He added that such a contract should call for an open price policy that would merely provide for "market price" at the time of shipment. This policy would give complete protection to the utility field and make for honest public pricing on the part of coal industry.

Aluminum . . . "The aluminum industry as a whole looks forward to a substantial increase in the demand for its metal for electrical uses," according to Thomas D. Jolly, vice president for engineering and purchasing, Aluminum Co of America.

Productionwise, Jolly said, primary output this year should approach 1.5 million tons compared with 1.25 million tons in 1953. As for future demand, he said one estimate suggests it might possibly quintuple between 1950 and 1975, putting U. S. consumption at 3.6 million tons.

Steel . . . The steel situation was analyzed by William M. Rooney, market editor of "Steel," Cleveland, Ohio.

Although steel production this year will depend upon the volume of business generated in various areas of uses, Rooney asserted that "No severe recession is indicated . . ." Instead, he said prospects are good that the mills this year will turn out between 95 and 100 million net tons of ingots.

In commenting on the industry's steel expansion, he predicted, that over the next decade additional millions of tons of capacity will have to be added.

Copper . . . The copper market has the experts stumped, according to Dr Joseph Zimmerman, editor in chief of Daily Metal Reporter, New York.

Dr Zimmerman declared that the price of copper, which was expected to drop last June, is still between 29½ and 30¢ and added that copper may continue in this price category until after Chilean copper is offered for sale in world markets at the world price.

MANUFACTURING BRIEFS

M. W. Kellog Co, New York, was one of seven engineering and construction companies receiving outstanding safety awards last year from the National Constructors Association. The association is composed of leading companies specializing in design and construction of power and chemical plants, steel mills, and oil refineries.

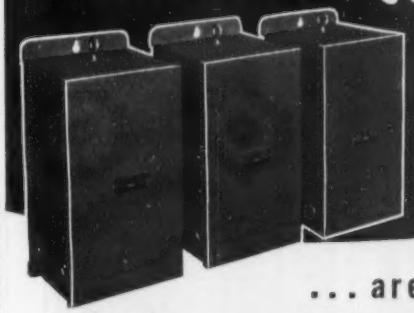
Reliance Electric & Engineering Co, Cleveland, has placed contracts for a new addition to its Ashtabula, Ohio, Division plant. The building will be a single story, 90,000 sq ft structure of steel, concrete, and brick.

American Creosote Works has converted a pressure treating cylinder at Winnfield, La., to pentachlorophenol. It will meet "a need to supply a ready market for clean penta treated products." The cylinder is 100 ft long, with a 7-ft diameter.

Aluminum production during the first quarter of 1954 will be about 693.2 million lb, compared with 651 million lb in the last three months of 1953, according to the government's General Services Administration. Of the new total, 260,887,000 lb will come from facilities built after the Korean outbreak.

WHERE SAFETY AND DEPENDABILITY COUNTS...

MARCUS dry type TRANSFORMERS



3 of the 19 Marcus transformers installed, with ratings up to 150 KVA.

... are STAR PERFORMERS at the Cincinnati Garden!

Feeding the power where and when needed at Cincinnati's huge and busy "Garden" is another important assignment for MARCUS Dry Type Transformers.

Because all Marcus Dry Type Transformers are now being constructed with Hi-Heat, Hi-Dielectric Magnet Wire, insulation levels of at least 10 times present industry standards are easily attained.

This factor alone, plus an enviable record of trouble-free performance and matchless dependability made Marcus Dry Type Transformers the choice of the Beltzhoover Electric Co., of Cincinnati, Electrical Contractors for the project, and A. M. Kinney, Inc. the consulting Engineer on the job.

Increase your power Performance Standards with Marcus Dry Type Transformers.

Capacities from 1 to 3000 KVA

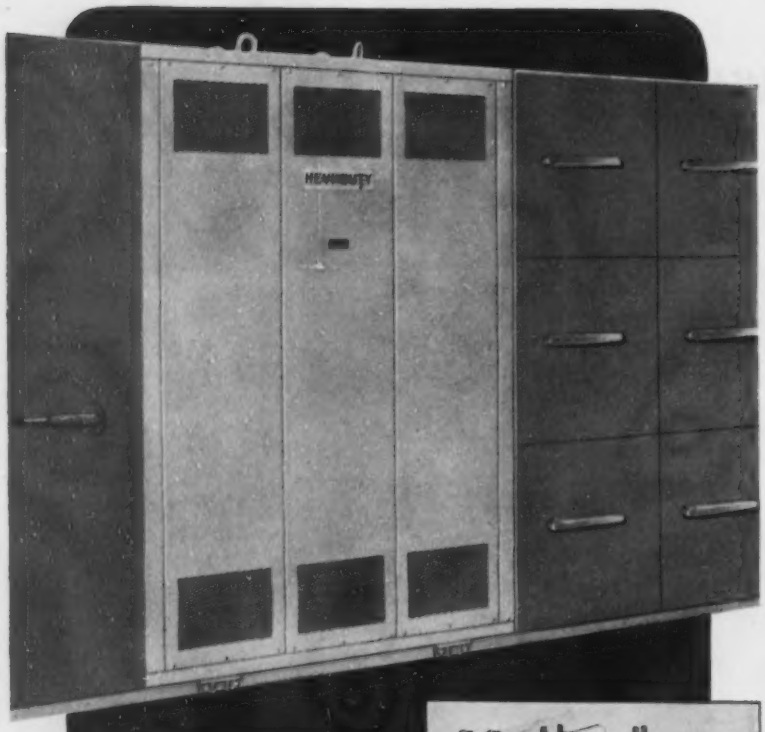
- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

"Mark of Quality"

Representatives in Principal Cities

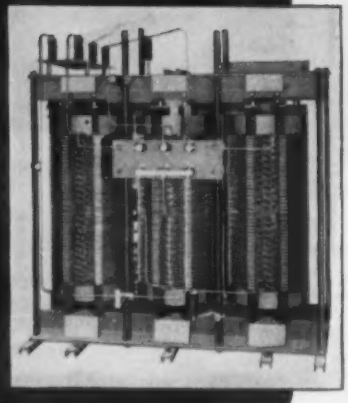
MARCUS TRANSFORMER CO., INC.
HILLSIDE 5, NEW JERSEY

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY



HEVI DUTY

High Voltage Unit Sub-Station Transformers



INCREASE EFFICIENCY OF LIGHTING AND POWER CIRCUITS BY SUPPLYING EQUIPMENT WITH THE CORRECT VOLTAGE

When you need electric power, you can count on Hevi Duty Dry Type Transformers for dependable service. These transformers are engineered to meet or exceed all the requirements necessary for long life.

Note the adequate core and coil blocking, high voltage insulators and well ventilated pancake type coils on the Type 31FH, 300 KVA, 13,200-208Y/120 volt, 60 cycle Transformer shown here.

Hevi Duty Dry Type Transformers can be supplied separately or as a Unit Sub-Station complete with primary and secondary switch gear according to your specifications.

Write for Bulletin HD-499.

HEVI DUTY ELECTRIC COMPANY

MILWAUKEE 1, WISCONSIN

Heat Treating Furnaces... Electric Exclusively

Dry Type Transformers ***Constant Current Regulators***

MEETINGS CALENDAR

Southern Safety Conference-Exposition
Kentucky Hotel, Louisville, Ky., March 7-9.

National Electrical Manufacturers Association
Spring Meeting, Edgewater Beach Hotel, Chicago, March 8-11.

Interstate Power Club
Meetings will be held at Hotel Martinique, New York, on following dates: March 10, May 10, Oct. 11, Dec. 6.

American Society of Mechanical Engineers
International Meeting, through cooperation of Mexico Section, Hotel Del Prado, Mexico City, Mex., March 10-12; Semi-Annual Meeting, William Penn Hotel, Pittsburgh, June 20-24; Fall Meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 8-10.

Atomic Industrial Forum, Inc.
Hotel Biltmore, New York, March 15-16.

Edison Electric Institute
Industrial Relations Committee, EEI Headquarters, New York, March 18; 20th Annual Sales Conference, Edgewater Beach Hotel, Chicago, April 5-8; EEI-AGA Accounting Conference, Hotel Statler, Boston, April 12-14; Industrial Relations Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, April 15; 22nd Annual Convention, Atlantic City, N. J., June 1-4.

Pacific Coast Electrical Association
Engineering and Operating Sections, Mark Hopkins Hotel, San Francisco, March 18-19; Administration Services Section, Hotel Claremont, Berkeley, Calif., April 7-8; Annual Convention, Hotel Del Coronado, Coronado, Calif., May 19-21.

Southeastern Electric Exchange
21st Annual Meeting, Boca Raton Hotel, Boca Raton, Fla., March 22-24; Spring Meeting, Engineering and Operation Section, Sans Souci Hotel, Miami Beach, Fla., May 6-7.

Institute of Radio Engineers
1954 National Convention, Waldorf-Astoria Hotel and Kingsbridge Armory, New York, March 22-25.

Electrical Industry Show
Sponsored by Electrical Maintenance Engineers Association of Southern California, Shrine Exposition Hall, Los Angeles, April 1-3.

***American Institute of Electrical Engineers**
6th Conference of Subcommittee on Rubber-Plastics Industries of Committee on General Industry Applications, Mayflower Hotel, Akron, Ohio, April 5-6. Conference on Feedback Control, Claridge Hotel, Atlantic City, N. J., April 22-23; Northeastern District Meeting, Hotel Van Curler, Schenectady, N. Y., May 5-7; Conference on Telemetering, Morrison Hotel, Chicago, May 24-26; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25; Fall General Meeting, Chicago, Ill., Oct. 11-15.

Northwest Electric Light & Power Association
Engineering and Operation Sections, Olympic Hotel, Seattle, Wash., April 15-17; Pusines Development Section, Hotel Boise, Boise, Idaho, May 10-12.

***Pennsylvania Electric Association**
Systems Operation Committee, Bedford Springs Hotel, Bedford Springs, Pa., May 6-7; Prime Movers Committee, Castleton Hotel, New Castleton, Pa., May 17-18.

National Association of Electrical Distributors
Annual Convention, Atlantic City, N. J., June 6-11; Pacific Zone Convention, Mark Hopkins Hotel, San Francisco, Oct. 4-7.

World Power Conference
Sectional Meeting, Rio de Janeiro, Brazil, July 25-Aug. 10.

Pan-American Federation of Engineering Societies
(UPADI), Third Convention, Sao Paulo, Brazil, Aug. 2-12.

***Addition this week.**

Puget Sound P&L

(*Continued from page* 102)

and "it is currently anticipated that the company will do better in 1954," Pres Frank McLaughlin said. Common stock earnings were $1.85 as compared with $1.50 in 1952.

McLaughlin supported his statement by quoting from Charles Tatham, Jr, vice president of Institutional Utility Service, Inc, of New York, who reported that "our projection of earnings indicate that around $2.35 per share should be achieved within three years and close to $2.80 a share within five years," meaning dividend distribution of from $1.90 to $2.10 per share on a payout ratio of from 75% to 80%.

"We believe that the common stock has a present reasonable investment value closely centering around $33 a share," said Tatham. "Over the long range considerably higher values can be looked forward to, with a level of around $40 to $46 per share reasonably in prospect within ten years."

Superior Court Halts Georgia PSC Rate Order

A move by the Georgia Public Service Commission to make Georgia Power & Light Co, a subsidiary of Florida Power Corp, buy power from Georgia Power Co has been temporarily halted by a court order. However, utilities in both states are watching closely the legal action in Fulton Superior Court in Atlanta.

Question of whether the PSC has legal power to make such a change is expected to wind up in the state supreme court. It involves an injunction suit brought against the PSC by Georgia Power and Georgia P&L.

Hearing Postponed . . . The two companies asked, and got, a temporary injunction on a PSC public hearing, at which they were to "show cause why":

1. The PSC shouldn't set a rate schedule for Georgia Power to sell energy to the Georgia P&L and set rates the same as Georgia Power's to cities or REA co-operatives.

2. Georgia P&L shouldn't be ordered to buy its energy from Georgia Power at the rate set by PSC.

3. PSC shouldn't reduce rates of the Georgia P&L to the level of the Georgia Power if the two could not

Expect 5 to 8 YEARS protection

for galvanized towers from a

SINGLE COAT OF SUBOX

There's no better anti-corrosive pigment for painting over galvanizing than active suboxide of lead—the basic pigment in Subox and Subalox paints.

There's no surer way to get economical and effective preservation of galvanized structures than by coating them with Subox or Subalox. In most instances, a single coat is sufficient and Subox or Subalox—will not chip, crack or blister during years of exposure to the elements.

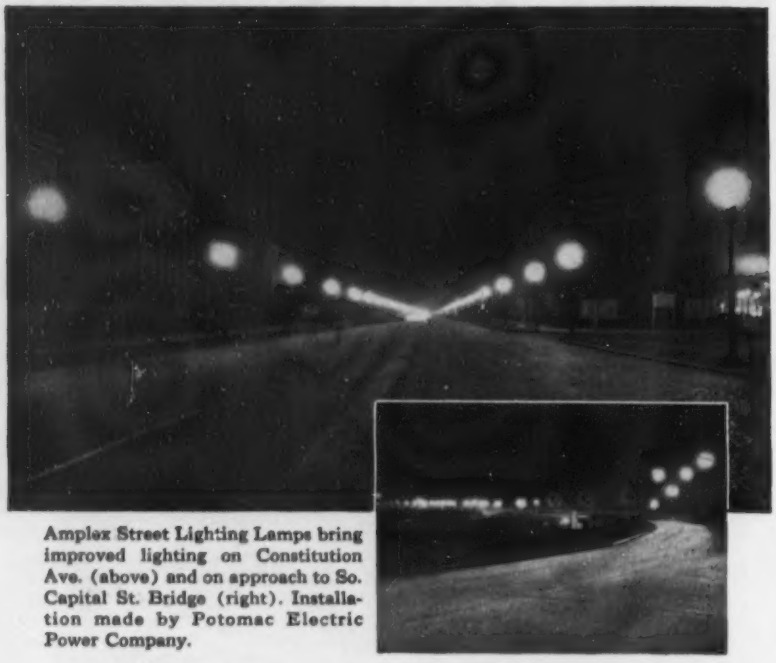
What's more, repainting is simpler and more economical when these paints are used. They cost no more than any good paints, and can be relied on to save you money for years.

Write for a free copy of "Paint Galvanized Transmission Towers for Long Life".

Subox Inc. 3 FAIRMOUNT PLANT HACKENSACK, N. J.

Better light in the nation's capital!

AMPLEX STREET LIGHTING LAMPS



Amplex Street Lighting Lamps bring improved lighting on Constitution Ave. (above) and on approach to So. Capital St. Bridge (right). Installation made by Potomac Electric Power Company.

FROM ONE COAST TO THE OTHER, Amplex Street Lighting Lamps are the fastest-growing choice of cities and utilities. Experience shows that these lamps give outstandingly superior service . . . and so they should! They're designed and premium-built to withstand the vibration and jolts of fast-moving traffic . . . to burn longer and to maintain their high light output.

In the Amplex line there's a street lighting lamp of the right type and wattage for every purpose. And for truly maximum life and dependability there's nothing equal to Amplex *Weatherproof Bulbs*. They're made of moisture-resistant "hard glass" that survives the severest climatic conditions and cuts service costs to new lows.

It will pay you to get all the facts about Amplex Street Lighting Lamps. Just write **Amplex Corporation, Dept. J-3, 111 Water St., Brooklyn 1, N. Y.**

AMPLEX

Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.

get together either on a power sale arrangement or a merger.

The Securities and Exchange Commission would be asked to affect the merger, according to the PSC order.

Members of the PSC contend that the Georgia P&L could save about $600,000 a year by buying from Georgia Power at current REA rates, or $300,000 at regular industrial rate.

Hearing has been set in Fulton Court for March 22 to determine if the injunction shall become permanent. Attorneys for both sides indicated they'll appeal on adverse decision.

Electric, Gas Financing Set New Record in 1953

Electric and gas corporate financing set an industry record for the year 1953, according to a statistical report by the Securities and Exchange Commission.

The industry floated a total of $3.1 billion worth of issues, $400 million more than in 1952. This represents 34% of all corporate securities offered for cash sale in the U. S. during the year, and the electric and gas industry was the largest single group of issuers in the country.

Manufacturing companies, which made up the largest group in 1952 with offerings of over $4 billion, issued only a little more than half that amount in 1953. All industry financing totalled $8.9 billion, just 7% below the $9.6 billion record set in 1952.

The utility industry also had the highest proportion of plant and equipment expenditures financed by securities issues, 63%. Despite the fact that capital expenditures increased to new record levels in 1953, total corporate issues to finance new plant and equipment amounted to $5.8 billion in 1953, about $600 million less than 1952. For all industries, new securities provided only 25% of the estimated total spent for capital expansion in 1953.

FINANCIAL BRIEFS

After expiration of a contract deadline to sell Gas Service Co to Missouri Public Service Co for $32 million. Cities Service Co is reinstituting arrangements to sell its 1.5 million shares of Gas Service in a public offering.

SPA Staff Cuts . . .

. . . and sweeping reorganization of power marketing agency ordered by Interior

Interior Department has ordered a sizable cutback in personnel and a sweeping reorganization for Southwestern Power Administration to put it on a business-like basis.

In a memorandum to SPA Administrator Douglas Wright dated Feb. 18, Assistant Interior Secretary Fred G. Aandahl directed:

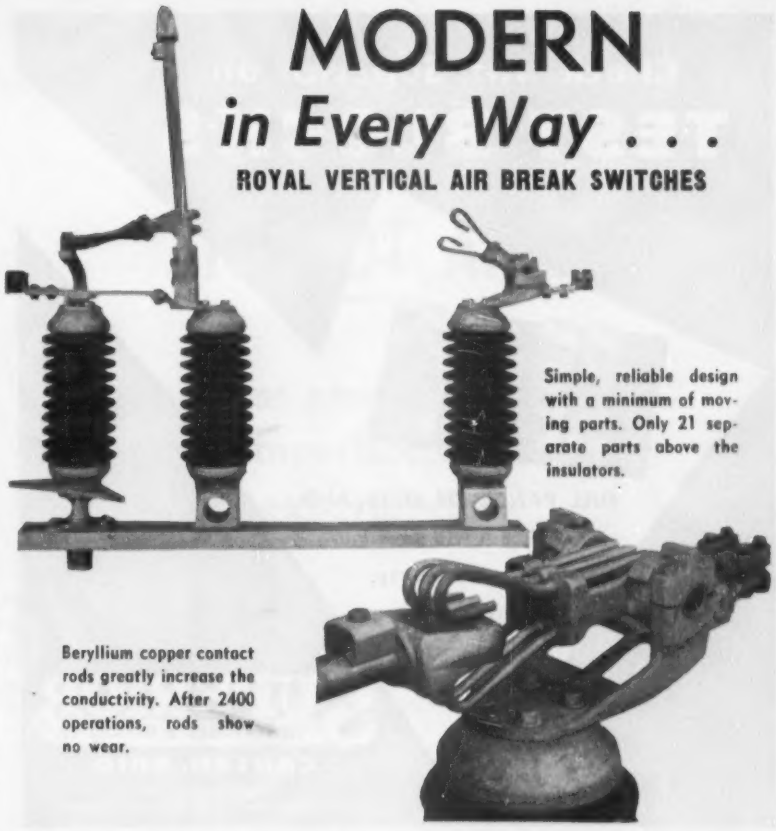
- That SPA's Washington office be discontinued by May 1.
- That the SPA organization be reduced from the present 256 positions to 180 positions by May 1.
- That a schedule be submitted within 60 days for further reduction of the SPA work force to 86 positions.
- That the agency drastically be reorganized to permit these reductions in personnel.

Recommendations Followed . . . The directive was approved by Interior Secretary Douglas McKay and Undersecretary Ralph A. Tudor. It follows almost to the letter the recommendations of a survey team appointed by Interior to study SPA organization. The team consisted of Roy Martindale, a Los Angeles consulting engineer formerly with the Los Angeles Department of Water and Power; Alexander J. Paull, director of personnel, Cleveland Electric Illuminating Co; and Arthur B. Vieregg, a career government employee formerly with Defense Electric Power Administration.

SPA is to be responsible for operating and maintaining approximately 1,100 miles of transmission lines, 18 substations and administering some 52 contracts for sale of government produced power in the Southwest. With the major part of the construction work already completed and with most of the contracts negotiated, the survey team felt that a reduction-in-force was immediately necessary.

Further Cut Suggested . . . Upon completion of rate studies in cooperation with Federal Power Commission and negotiation of a few remaining power contracts, the team recommended a further reduction in personnel to 86 positions. This was less than half the number of positions recommended by

MODERN
in Every Way . . .
ROYAL VERTICAL AIR BREAK SWITCHES



Simple, reliable design with a minimum of moving parts. Only 21 separate parts above the insulators.

Beryllium copper contact rods greatly increase the conductivity. After 2400 operations, rods show no wear.

Royal Electric's newest model type VVL air break switch incorporates the latest advances in the industry—Beryllium copper contact rods, high pressure point contacts, permanently sealed lifetime bearings, and fault-compensating high pressure contacts. The VVL means reliability.

Advantage is taken of electro-magnetic repulsive forces to increase contact pressure during high current-periods, particularly so during fault-current.

High pressure contacts at both hinge and front ends. At the hinge ends, contact fingers permanently engage the contact pin providing continuous annular contact. The first switch to eliminate braid shunts in its design (1937).

Aircraft type sealed ball bearings packed with Silicone grease provide operation to -60 deg. F. and freedom from maintenance.

For engineering data on the full line of switchgear, connectors and substation fittings produced by Royal, write for a copy of our new Catalog No. 12.

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ROYAL ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET Chicago 19, Ill.

Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

Check with Superior on
TEST BLOCKS

FULL RANGE OF SIZES AND TYPES that will save you time and money.
Write to . . .

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

Introducing

..the PENGO safety
TRANSFORMER GIN
RUTTER DESIGN
made of molded OWENS-CORNING FIBERGLAS

STRENGTH-WEIGHT RATIO 3 TIMES THAT OF STRUCTURAL STEEL

SAFEST Moisture proof! Will not absorb moisture even when abused. High electrical resistance — tested to over 100,000 volts, and . . .

STRONGEST Each Gin tested to 4500 lbs. single line pull.

LONG LIFE Nearly indestructible. Impervious to sun, heat, cold, water, oil, most acids, corrosion, rotting.

EXCELLENT DESIGN Goes up the pole in one piece. Pivots for moving transformers from old pole, or installing bank of transformers.

SPECIFICATIONS

Working load, single line	2500 lbs.
(One-third more with double line)	
Length	6' 2"
Weight	35 lbs.

Made by the makers of the World-Famous PENGO EARTH AUGER

PETERSEN ENG. CO.
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Administrator Wright to carry out the agency's future commitments.

The survey team further recommended that SPA be designated as the Division of Power Marketing and headed by a power manager with headquarters in Tulsa. This recommendation is contingent, the team said, upon the appointment in the Office of the Secretary of a power administrator responsible for the direction and policy interpretation of SPA as well as other Interior power marketing agencies.

A similar survey of Bonneville Power Administration is slated to get underway before the end of the month.

New TVA Substation Controlled by Microwave

Tennessee Valley Authority has placed in service a new 161-kv primary substation which is remotely controlled by microwave. Located at Calvert, Ky., the station is unattended. The microwave channel control is from the Kentucky Dam powerhouse, five miles away. Station transformer capacity is 100,000 kw. There are four 154,000-volt transmission lines terminating in it. All meter readings, alarm indications, and controls for these facilities are carried to the operator at Kentucky Dam over the microwave channel. Telephone communications are also by microwave.

This is the first use TVA has made of microwave radio channels for supervisory control of a substation. It brings to a total of 18 the number of substations and hydro plants now operated under supervisory control on the TVA system. This function previously has been performed over carrier telephone circuits.

Pennsylvania P&L Upheld in Liability Test Case

Pennsylvania Power & Light Co, Allentown, was absolved of blame in a test case to determine the liability of power companies for damages when an airplane strikes high tension wires and the flier is fatally injured when Judge William H. Neely in Dauphin County Common Pleas Court dismissed the case early this month.

The test case was brought by Morris

Yoffee, of Harrisburg, administrator of the estate of his brother-in-law, Morris B. Levitz, of Lebanon, who was killed May 10, 1950, when his plane struck the high tension wires of the Pennsylvania P&L a mile south of Millersburg where the electric lines span the Susquehanna River.

Judge Neely granted a compulsory nonsuit after he ruled that Yoffee had failed to show any negligence on the part of the defendant company or that Levitz was entirely free of contributory negligence. The evidence showed that Levitz was flying only 125 ft above the water line of the river when the airplane he was piloting struck the high tension wires.

Counsel for the Levitz estate said a motion made would strike off the compulsory non-suit.

Foreign Firms Won't Be Expropriated: Vargas

SAO PAULO (McGraw-Hill World News)—In an obvious comment on his Dec. 19 Curitiba statement about expropriating foreign power companies, Brazil's President Vargas declared this month "I do not intend to nationalize either foreign assets or capital. I do not intend to take over or expropriate companies."

"My duty is to avoid denationalization of Brazil," he added. "This is what calls for creation of Electrobras [national electric company]. Since it is we, ourselves, who have to solve the problem; let us solve it."

Vargas explained that on the average hydroelectric installations need 30% of equipment purchased abroad and 70% which can be made by Brazilians using local materials. He noted that concessionary companies cannot bear the responsibility of investments, that part of national capital can be supplied by Brazil, and that part of foreign capital for purchase of machinery and installations is only supplied under government guarantee.

Under such conditions, said Vargas, the government would be negligent to permit power companies to remit profits from power produced with Brazilian labor, using Brazilian materials, and using equipment imported with Brazil-guaranteed exchange.

"It is clear that this program will hurt those interested in this business," Vargas declared, apparently referring to the foreign power companies.

All Air-Cooled Dry-Type Transformers Are NOT Alike

This was proved by tests, comparisons and experiences

THAT there is a difference in dry-type transformers was revealed in the findings of a survey made by *Plant Engineering*, a trade publication, which mailed 500 questionnaires to users of dry-type transformers. (A copy of this report will be sent on request.)

Most of the users who returned questionnaires reported having very favorable experiences with air-cooled dry-type transformers. A number of unfavorable reports listed the following reasons: "Some makes won't even handle their rating." "Some are very noisy." "Primary shorts." "The insulation breaks down without overload in relatively short time." Some recommended "mounted lugs for connections."

The unfavorable comments above *do not apply* to Sorgel air-cooled dry-type transformers.

SORGEL air-cooled dry-type transformers are guaranteed to carry the full rated load continuously, and are so liberally designed that they can safely carry an overload during an emergency. They are well known for their quiet operation. All are equipped with solderless terminal lugs.

Because these superior features cost more to incorporate in Sorgel air-cooled transformers, our price may not always be the lowest; however, the little additional price you might sometimes pay will be saved several times over in extra service and lower installation costs.

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SORGEL air-cooled dry-type transformers are top quality, time-tested, and are therefore recognized and accepted by discriminating engineers and users.

These transformers are available in a large variety of sizes and types for every purpose. ½ Kva to 1,000 Kva single phase. 1 Kva to 3,000 Kva 3-phase. All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special lower voltages.

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WHAT THEY'RE SAYING

At Industry Meetings

Electric Rates Must Compete With Other Energy Sources

BENJAMIN F. FAIRLESS, chairman of the board, United States Steel Corp, before The Future Power Market Forum, Pittsburgh.

Even if we take a conservative view of the situation and assume that the per capita consumption of steel will not increase, and that our electrical consumption per ton of steel produced will not increase, then in twenty years we will consume about seven and one-half billion more kilowatt hours annually than we do today.

This seven and one-half billion kilowatt hours is about equal to the expected annual output of one of the largest generating stations under construction today—the Clifty Creek Station of the Ohio Valley Electric Corporation at Madison, Indiana.

It is evident that one large factor in the cost of producing steel is the cost of energy. In other words, there must always be a close relationship between steel, kilowatts and dollars.

Lest you misinterpret my emphasis on low cost electricity requirements for some of the new processes I have spoken of, I would like to say, here and now, that we are not seeking power at give-away prices.

All I am saying is that power must be priced competitively with other sources of energy. On this basis, electric power and steel can be drawn even closer together within the great family of American industry.

Mass Production Has Erased Many Social Barriers

A. C. MONTEITH, vice president, Westinghouse Electric Corp, before St. Louis Electrical Board of Trade

Mass production, spearheaded by the electrical industry, and electric power generated and distributed throughout the nation, has erased many social barriers and guided us to an equality which would amaze many of the framers of the Constitution, foresighted though they were.

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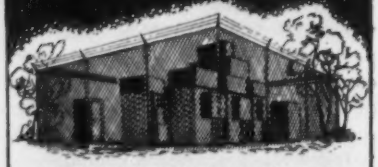

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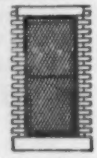

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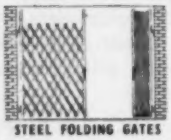

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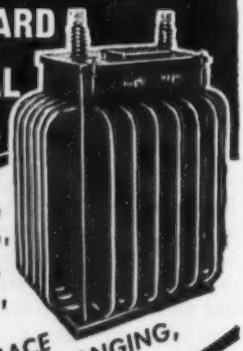

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Air Conditioning Sales: Onward and Upward

CLOUD WAMPLER, president, Carrier Corp, at introduction of 1954 residential equipment line, New York City.

All together, including the entire range of equipment for office buildings, industrial plants, hotels, hospitals, department stores, and other large structures, as well as residences and smaller commercial applications, the air conditioning industry should do a total retail volume of more than $2 billion in 1954.

Beyond this there should be a steady increase with the $3 billion mark reached in 1958 and $5 billion within ten years from now.

Tax on Electric Works Would Open Municipalities to All Taxes

ALEX RADIN, general manager, American Public Power Association, before conference of California Municipal Utilities Association

I think it is well to note . . . that the threat of federal taxation on muncipal electric systems is a threat of taxation on all municipal functions. This was clearly stated in 1951 by Congressman J. M. Combs of Texas, at that time a member of the House Ways and Means Committee.

Referring to the proposed excise tax on the electric systems as "a dangerous precedent," Mr. Combs added: "In effect, it is a tax placed by the federal government on local government. If the national government can levy a tax on a city for the electric energy it generates and dispenses, it can likewise tax a city on the revenues derived from its water or sewer system, or any other similar source of municipal revenue."

We firmly believe that the taxation of local governmental units by the federal government would be an important wedge in destroying the historic separation of powers between the federal government, on the one hand, and the state and local governments, on the other hand.

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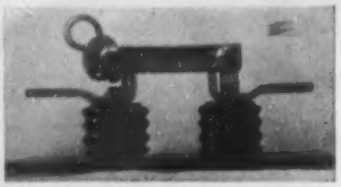
All replies will be held as a strict confidence.



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BOOK REVIEWS

Economics

The American Economic System **by Edwin Vennard and Robb M. Winsborough. Published by Row, Peterson and Co, Evanston, Ill, 96 pages, illustrated, price $1.00**

This booklet presents in an interesting and attractive manner fundamentals of the American economy system. It contains illustrations which have been tested through wide use in economic education courses for employees of both the power and other industries. The booklet is designed primarily for high school students. However, its appropriateness for this intellectual level should make it of great value for employee-education programs covering this subject.

AC Machinery

Electrische Maschinen. **Vol. II. By Rudolf Richter. Published by Birkhauser, Basel/Struttgart, Germany. 707 pages, illustrated. Price 46.80 DM or Fr.**

This is a revision of Richter's 1929 book but in this instance it defers transformers to volume III. The contents here are defined as "synchronmaschinen and einankerumformer". It is considered the outstanding German text on synchronous machines inasmuch as it treats the theory and design in comprehensive penetrative manner and then goes on to give structural details in similar degree. The combination treatment thus affords a fine insight into differences in refinement of American and continental European machines.

Atomics

Nuclear Physics. **By W. Heisenberg. Published by Philosophical Library, New York 16, 225 pages, illustrated. Price $4.75.**

Translated here are eight lectures by the German nuclear physicist aimed at rendering the subject understandable by historical tracement and in terms as simple as possible. Step by step he follows the invention of the proton neutron, meson, neutrino, etc. until it is possible to discuss the nuclear reactor. An appendix explains how near Germany could have come to an atomic bomb if Hitler had not been so intent on a quick war and if the British commandos had not punctured the heavy water tanks in the German-held Norwegian hydro plant.

Self Synchronous Mechanisms

Synchros, Self-Synchronous Devices and Electrical Servo-Mechanisms. **By Leonard R. Crow. Published by The Scientic Book Publishing Co, Vincennes, Ind. 231 pages, illustrated. Price $4.20 postpaid in U. S. A.**

Best known, probably, for their widespread use in aircraft controls and position indicators, synchros and allied self-synchronous mechanisms are gaining acceptance by industry.

The book aims to contribute a broad understanding of the basic principles involved in applying such devices. It is

written for use in colleges and special training courses, and to inform practicing engineers and technicians. Adequate illustrations and informative laboratory experiments should make it good for these purposes.

Utilities may well find growing use of self-synchronous devices in centralized control installations. Their control engineers should find this book helpful in appraising possible applications and in training personnel in the proper methods for operation and maintenance.

The Young Engineer. **By Charles B. Broschart. Published by Exposition Press, Inc., New York 16, 241 Pages, illustrated. Price $3.00.**

Assistance to the father besieged with questions about technical and scientific things by a teen-age son is the primary objective of this book. The author accepted as his duty the obligation to answer his own son's questions. And the research it required provided the information included in this book.

Pages are devoted to kites and aeroplanes, to ships, engines, automobiles and trains. What makes seasons of the year, eclipses of the sun, thunder and lightning are discussed. And then comes radio, telephone, electricity, movies, cameras and television. Test of the author's success was provided by the reviewer's ten-year-old who read more than half with avid interest, but balked where simple trigonometry exceeded his educational experience.

Engineers with teen-age children will find this book useful. For it answers many questions with more skill and patience than most can muster. Time alone will test the author's secondary objective of stimulating children's interest in engineering as future life work. But gaining this interest at an early age is undoubtedly a sound approach.

Electricity Case-Problems

Electrical Engineering Instruction. **By Lester E. Beck. Published by Tri-State Offset Co., Cincinnati 2, Ohio. 407 pages, illustrated.**

The author has a new approach to the presentation of electrical engineering essentials which he classifies as follows: (1) Instantaneous and Direct Currents, (2) Direct Current Machines, (3) Sinusoidal Alternating Currents, (4) Alternating Current Machines, and (5) Electronics and Rectification. The various topics are arranged as a sequence of 385 case-problems, each designed as a stepping-stone to those which follows. In each case the known facts are given, the objective is stated, and the available means for attaining the objective are then investigated. The work is carried out on a middle ground which is neither highly mathematical nor predominantly descriptive. All circuits and machines are analyzed from the energy viewpoint. The large volume is 8½ by 11-in. size, using two-column format. Combining the functions of a textbook and a problem sequence, the book is primarily for engineering students and should be useful also as a reference for electric utility engineers.

Applied Electricity

Applied Electricity—2nd edition. **By H. Cotton. Published by the Industrial Press, New York 13, N. Y. 482 pages, illustrated. Price $4.50.**

The English author presents the fundamentals of electricity, beginning with the theory of the atomic structure, then carries on the theory of magnetism, electrostatics and electromagnetism. Application of electrical theory to generators, transformers, motors, lighting equipment, electronic equipment and measuring instruments is well covered. New sections include the photocell, circle diagrams and the meter-kilogram-second (MKS) system

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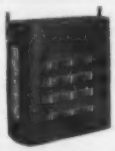

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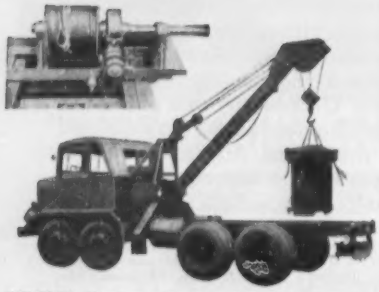

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of units. Many examples are provided in the text and at the end of the book many problems are listed for practice. This volume is a comprehensive presentation for the student and provides an easily scanned reference of fundamental principles for the practicing engineer.

How the Farmer Can Use Arc Welding

Farm Arc Welding. Published by the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. 456 pages, illustrated. Price $2 in U. S., $2.50 elsewhere.

This is a handbook for building, repairing and servicing farm equipment by the use of arc welding. It should be of real value to farm service men of electric utilities, making them more helpful to their customers. The first part of the book consists of general welding information—how to use the welder, planning and equipping the farm shop, and procedure in welding and cutting. The second part is comprised of 20 sections in which are detailed instructions covering hundreds of welder use operations in the repair, alteration and construction of all types of farm equipment, buildings and other facilities. The third part presents tabulated data on steel bars and sheets, properties of metals, standard dimensions, etc.

TECHNICAL LITERATURE

1952 ISA PROCEEDINGS—Seventy-seven technical papers and 21 abstracts are included with 1952 Instrument Conference records in this 350-page book. Price is $5.00, or $10.00 for non-members. Instrument Society of America, 1319 Allegheny Ave, Pittsburgh 33, Pa.

MARKS' HANDBOOK—The revised fifth edition of Marks' Mechanical Engineers' Handbook has been announced. A new enlarged format of 6 x 9 page size contains 2,236 pages and over 12,000 index entries including atomic power and other developments of the past 10 years. Price $15.00. McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36, N. Y.

BELL LAB MONOGRAPHS—The following technical monographs are available from Bell Telephone Laboratories, 463 W. St, New York 14, N. Y.:

2067 Optical aids for better seeing in industry
2119 Formation of negative ions of sulphur hexafluoride
2126 Modulation equipment design for modern single-sideband transmitters
2103 Properties of germanium phototransistors
2108 Properties of junction transistors
2110 Component unreliability in military equipment
2111 Outdoor exposure testing of racks and test fences
2122 A coupled resonator reflex klystron
2125 Use of polyothylene as a capacitor dielectric
2130 First five years of the transistor

COPPER AND ALUMINUM CABLE—Bulletin RS-5 is a seven-page publication containing specifications and physical, sag, and tension data on triplex service drop and secondary cable, both copper and aluminum conductors, with either Neoprene or polyethylene insulation. Rome Cable Corp, Rome, N. Y.

TV SERVICE MANUAL—A 127-page composite TV service manual for television sets from 1947 through 1954 is now available. The table of contents uses a "model-chassis", 'chassis-model" cross ref-

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erence index. A photograph and full page schematic diagram for each model is included. Oscilloscope waveforms and critical voltages at important points are shown on the schematic diagram. Price $1.75. Westinghouse Electric Corp., 401 Liberty Ave, Pittsburgh 30, Pa.

TV REPAIR—A booklet has been published which is said to enable the owner of a color or black-and-white TV set to identify reception troubles and thus reduce time delays and costs of repairing. The householder identifies the disturbance on the screen with one of the 40 numbered pictures of defective reception contained in the booklet and calls the repairman giving him the number of the picture. The repairman has a technical version of the booklet which enables him to identify the tube or circuit causing the trouble before leaving his shop. Raytheon Manufacturing Co, Waltham 54, Mass.

INDUSTRIAL MANAGEMENT—The proceedings of the 17th Annual Time and Motion Study and Management Clinic held in Chicago in November 1953 have been published in a 168-page booklet. Complete transcripts of talks on topics including time study, motion economy, methods, plant layout, materials handling, wage incentives, maintenance, and human relations are included. Price $4.00. Industrial Management Society, 35 E. Wacker Dr, Chicago 1, Ill.

NEMA STANDARDS—Three standards are available from the National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y. They are:

DC 1-1953, NEMA Standards for Automatic Temperature Controls—$1.50

110-1953, American Standard Specifications for Rigid Steel Conduit, Zinc Coated—$0.50

111-1953, American Standard Specifications for Rigid Steel Conduit, Enameled—$0.35

AIEE STANDARDS—Three standards are available from the American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y. They are:

504, Test Code for Carbon Brushes—no charge

C37.12, Guide Specifications for Alternating-Current Power Circuit Breakers—$0.60

C39.2, Direct Acting Electric Recording Instruments—$0.75

TRANSFORMERS—Central Transformer Corp, Pine Bluff, Ark, have issued the following publications on transformers:

Instruction Book 1. A four-page booklet covering general recommendations for the operation and maintenance of indoor, openly ventilated, dry-type distribution, and power transformers with Class B insulation.

Instruction Book 100. A 20-page booklet covering general recommendations for the operation and maintenance of large oil-filled transformers.

HEAT PUMP—Bulletin 2330 is a 21-page publication with detailed information on the features, application, and performance of Westinghouse's heat pump. Sample calculations and installation data are given. Westinghouse Electric Corp, Hyde Park, Boston 36, Mass.

ASTM CONDENSER TUBE AND PLASTIC STANDARDS—The following standards are available from The American Society for Testing Material, 1916 Race St, Philadelphia 3, Pa.:

A179-53T, Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes

A213-53T, Seamless Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes

A214-53T, Electric-Resistance-Welded Heat-Exchanger and Condenser Tubes

A249-53T, Welded Austenitic Stainless Steel Boiler, Superheater, Heat Exchanger and Condenser Tubes

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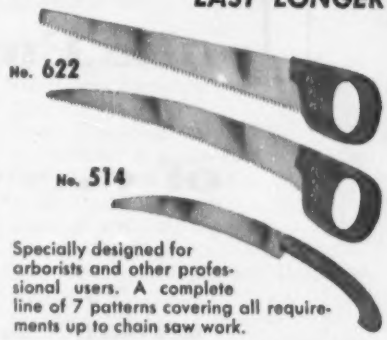

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The very lives of your employees are at stake. Yours is a grave responsibility. Consider what may happen.

When the emergency comes, everybody's going to need help at the same time. It may be hours before outside aid reaches you. The best chance of survival for your workers—and the fastest way to get back into production—is to know what to do and be ready to do it. To be unprepared is to gamble with human lives. Disaster may happen TOMORROW. Insist that these simple precautions are taken TODAY:

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's entirely integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here again, your CD Director can help—with advice on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First Aid Training Courses.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good employee relations—and no greater way of helping America.

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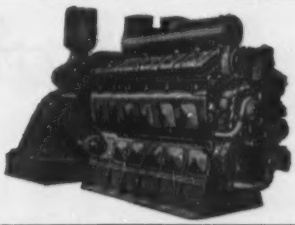

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1	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Coan. Exciter.
1	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P., 480-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1	13900	Whse.	25/60	13200 x 13200
1	3750	G.E.	25/60	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS
3 ph, 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	3000 3U	G.E.	514	600	4000/13200
2	2000	G.E.	450	250	2400
2	2000	G.E.	514	600	6600/13200
1	2000	G.E.	500	666 25 cy.	11000
2	1750	G.E.	514	250	2400
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	13200
1	1000	G.E.	900	260	4100/6900
2	1000	Whse.	900	600	2300/4150
1	750	Whse.	900	275	2300/4150
1	500	Whse.	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph	Voltages
1	5000	Whse.	OISC	3	33000x26400/13200
1	2500	Whse.	OISC	3	26400/13200 x 480
3	2000	G.E.	HVDDJ	1	66000 x 13800
1	1500	G.E.	HT	3	13200 x 2300
3	1250	G.E.	HVDDJ		6600/550
3	1000	G.E.	HVDDJ	1	2200/480

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Units of Every Size and Description

MOTOR GENERATOR SETS

K.W.	MAKE	A.C.	D.C.
1000 (3u)	Westgh.	1100	137/275
500	Westgh.	2300	137/275
500	Westgh.	2300	275
450 (3u)	G. E.	2300	125/250
400	A. C.	2300	120/240
300	G. E.	2300	250
200	G. E.	2300	250
200	Westgh.	4160	250
200	G. E.	440	550
200	Ridgeway	2300	250
170	G. E.	440	125
150	G. E.	440	125/250
150	G. E.	4000	250
150	A. C.	2300	275
150	G. E.	440	275
100	Westgh.	440	125
100	Elec. Mch.	440	125
100	Ridgeway	2200	275
100	G. E.	240	230
100	G. E.	440	125
75	G. E.	440	125
90	G. E.	440	60
60	Westgh.	2300	125
60	A. C.	2300	125
50	G. E.	240	250

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2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
2— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13200V. 440V.

SYNCHRONOUS MOTORS
1— 300 H.P., Elec. Mach., 720 RPM., 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM., 220V. 3/60.
2— 150 H.P., Al. Chal. 360 RPM. 440V. 3/60.

MOTOR GENERATOR SETS
1—1000 KW Whse., 600 V. 720 RPM. 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM. 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM. 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM. 4600V. Syn.
1— 150 KW G.E., 125/250V. 1200 RPM. 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM. 2300V. Syn.

SLIP RING MOTORS
2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM. 550V.
1— 250 H.P., West., CW. 600 RPM. 440V.
1— 200 H.P., West., CW. 600 RPM. 440V.
3— 150 H.P., Al. Ch. 1800 RPM. 2300V., 3PH. 60 Cy.

Large Stock of A.C. and D.C. Equipment

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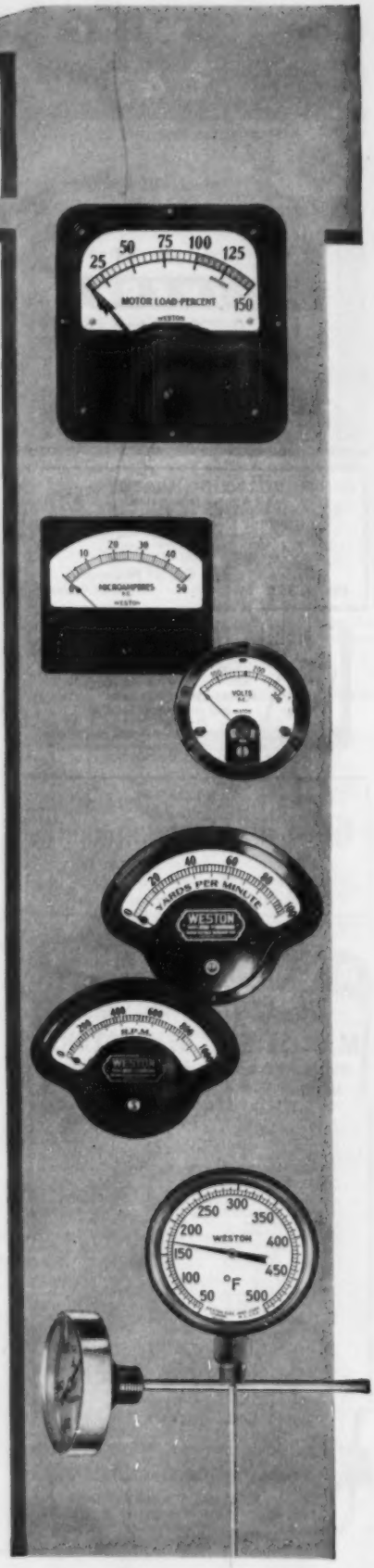

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FOR ELECTRONIC EQUIPMENT— WESTON panel instruments are available in 1½", 2½", 3½", 4½" and 5½" sizes in all required ranges and types, including d-c, a-c, rectifier and thermocouple types. Approved ruggedized and sealed instruments available in all types in 2½" and 3½" sizes. Special panel bulletins give complete information.

FOR RPM MEASUREMENTS— WESTON electrical tachometer indicators are available with scales calibrated in RPM, or any function of RPM, such as feet per min.—pieces per hour, etc. Indicators can be mounted remotely; and if required, more than one indicator can be operated from one generator. Special compact, lightweight a-c and d-c generators permit wide flexibility in mounting and connection arrangements. Directly indicate speeds from 1 RPM to 40,000 RPM or higher.

FOR TEMPERATURE MEASUREMENTS— WESTON Bi-metal thermometers are rugged and dependable, and are readily adaptable for built-in needs. Available in angle and straight stem types, stem lengths from 2" to 72", scale lengths 3.40" to 9", ranges low as −100°F. and high as +1000°F. Corrosion resisting stainless steel stems—accuracy 1° of thermometer range.

6402

Literature on any of the above instruments sent on request. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON *Instruments*

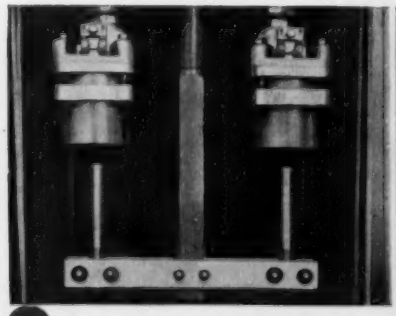
Get the breaker with these PLUS FEATURES

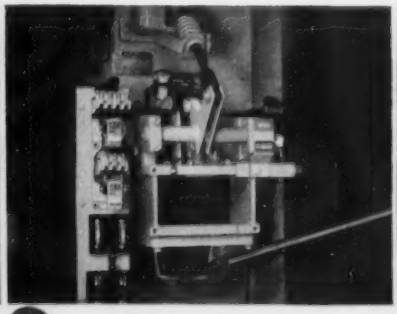
Here's increased operating convenience with high safety factor

TANK PER PHASE construction — as used in large breakers — eliminates possibility of internal phase-to-phase flashover.

ACCESS FROM THREE SIDES. Side hinging of L-shaped doors allows side as well as front access to operator cabinet. Operator is high speed solenoid type — mechanically and electrically trip-free. Linkage is basically same as used on large A-C breakers.

NO FALSE OPERATION of relays. Operate the breaker — slam the door — or let the wind slam it and relays can't operate accidentally. Relay panel is in separate cabinet from operating mechanism and is 4-point mounted on shock absorbers. No hinge wiring either! Separate door in rear of cabinet provides access to back of relays.





FLIP AND BAYONET CONTACTS are self wiping, self aligning. Note also, double break per pole design and time-proved *Ruptor* interrupting device are used. Here again, Allis-Chalmers is using the same quality construction as is used on large A-C breakers.

VISIBILITY PLUS. Maintenance closing device is side operated. Man closing breaker can observe contacts and man working on them. In addition, external position indicator easily visible at a distance from front or side. Inside position indicator also provided.

NO BURIED LEADS. Simply remove three pins at bottom of fabricating wiring duct to expose bushing current transformer leads. No conduits, pipes, fittings to remove. This is just one more feature that makes this the outstanding distribution-type breaker today.

GET COMPLETE INFORMATION. Call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

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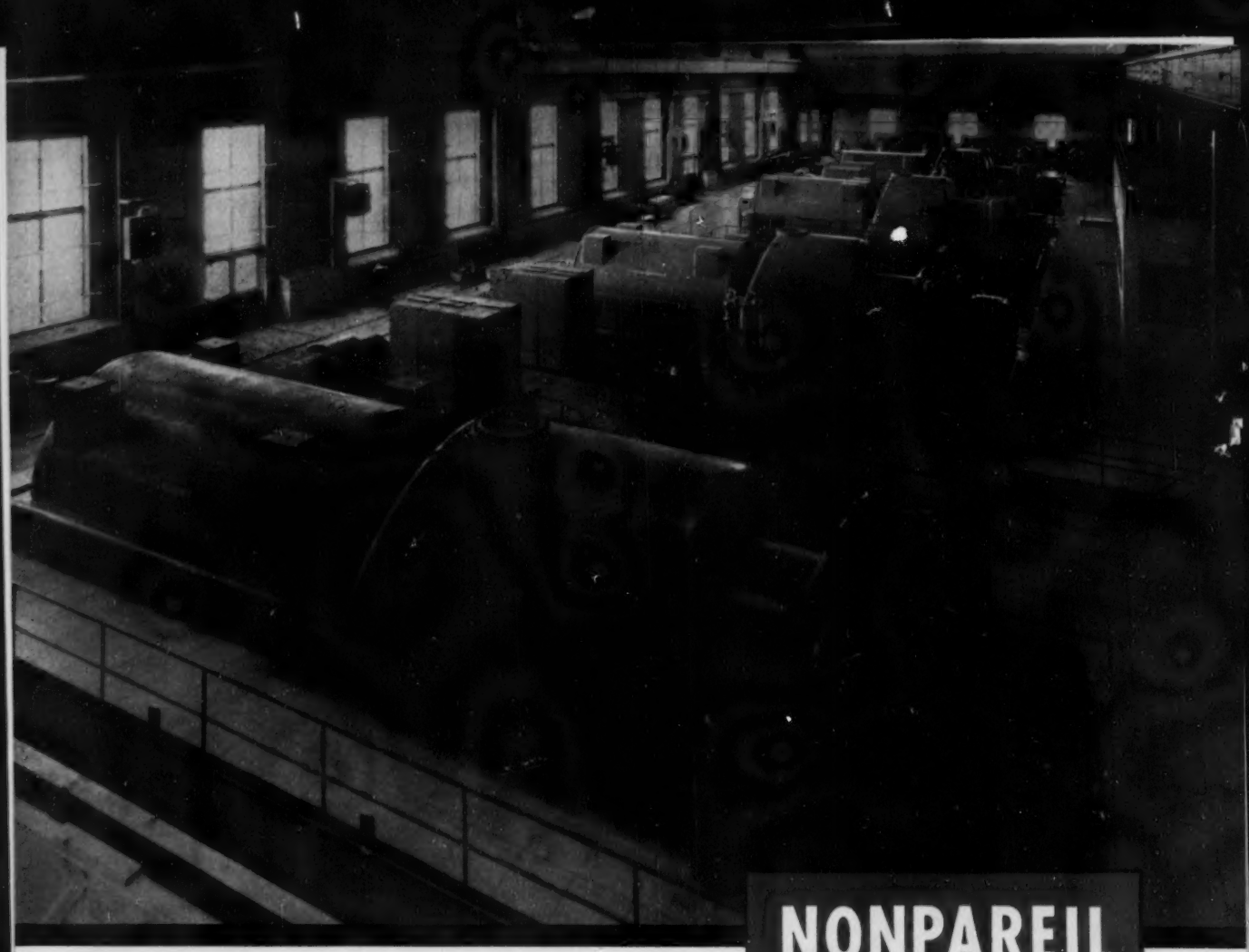

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